Vol. 17 OCTOBER, 1923 No. 2

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass., under act of July 16th, 1894.

40 CENTRAL STREET, BOSTON, MASS.

National Fire Protection Association.

INTERNATIONAL.

Executive Office, 40 Central Street, Boston, Mass., U. S. A.

OFFICERS

H. O. Lacount, *President*
Franklin H. Wentworth, *Secretary*
R. S. Moulton, *Assistant Secretary*

Rudolph P. Miller, *First Vice-President*
Dana Pierce, *Second Vice-President*
Albert T. Bell, *Chairman Executive Committee*

Members

American Institute of Architects.
American Institute of Electrical Engineers.
American Concrete Institute.
American Electric Railway Association.
American Gas Association.
American Marine Insurance Syndicates.
American Petroleum Institute.
Arkansas Fire Prevention Bureau.
Associated Factory Mutual Fire Insurance Companies, Inspection Department.
Associated Manufacturers of Electrical Supplies.
Associated Metal Lath Manufacturers.
Association of Edison Illuminating Companies.
Association of Electragists.
Association of the Fire Alarm Industry.
Association of Fire Underwriters of Baltimore City.
Association of Marine Underwriters of United States.
Board of Fire Underwriters of Allegheny County.
Board of Fire Underwriters of thePacific.
Board of Fire Underwriters of the Territory of Hawaii.
Boston Board of Fire Underwriters.
British Columbia Fire Underwriters' Association.
Bureau of Explosives.
Canadian Automatic Sprinkler Association.
Canadian Fire Underwriters' Association.
Canadian Manufacturers' Association.
Central Actuarial Bureau.
Chicago Board of Underwriters of Chicago.
Clay Products Association.
Committee of Manufacturers on Standardization of Fittings and Valves.
Common Brick Manufacturers' Association of America.
Compressed Gas Manufacturers' Association.
Cotton Insurance Association.
Electric Power Club.
Electrical Supply Jobbers' Association.
Engineering Institute of Canada.
Factory Insurance Association.
Factory Mutual Laboratories.
Federation of Mutual Fire Insurance Companies.
Fire Extinguisher Exchange.
Fire Marshals Association of North America.
Fire Underwriters' Electrical Bureau.
Grain Insurance Association.
Gypsum Industries.
Hollow Building Tile Association.
Hydraulic Society.
Idaho Surveying and Rating Bureau.
Illinois Inspection Bureau.
Improved Risk Mutuals
Indiana Inspection Bureau.
Institute of Makers of Explosives.
Insurance Association of Providence.
International Acetylene Association.
International Association of Fire Engineers.
International Association of Fire Fighters.
International Association of Municipal Electricians.
International Brotherhood of Electrical Workers.
Iowa Insurance Service Bureau.
Kansas Inspection Bureau.
Kentucky Actuarial Bureau.
Kentucky State Dept. of Fire Prevention and Rates.
Lightning Rod Manufacturers Association.
Louisiana Fire Prevention Bureau.
Michigan Inspection Bureau.
Millers' National Federation.
Missouri Inspection Bureau.
Motion Picture Producers and Distributors of America, Inc.
Mountain States Inspection Bureau.
Mutual Fire Inspection Bureau.
Mutual Fire Insurance Association.
Mutual Fire Prevention Bureau.
National Association of Building Owners and Managers
National Association of Credit Men.
National Association of Dyers and Cleaners.
National Association of Insurance Agents.
National Association of Manufacturers of Approved Hollow Metal Window Frames and Sash.
National Association of Manufacturers of United States.
National Association of Sheet Metal Contractors of United States.
National Automatic Sprinkler Association.
National Board of Fire Underwriters.
National Convention of Insurance Commissioners.
National Electric Light Association.
National Lumber Manufacturers' Association.
National Wholesale Druggists' Association.
Nebraska Inspection Bureau.
New Brunswick Board of Fire Underwriters.
New England Bureau of United Inspection.
New England Insurance Exchange.
New Hampshire Board of Underwriters.
New Jersey Schedule Rating Office.
New York Board of Fire Underwriters.
New York Fire Insurance Rating Organization.
Newfoundland Board of Fire Underwriters.
Nova Scotia Board of Fire Underwriters.
Ohio Inspection Bureau.
Oil Insurance Association.
Oklahoma Inspection Bureau.
Oregon Insurance Rating Bureau.
Philadelphia Fire Underwriters' Association.
Philadelphia Suburban Underwriters' Association.
Portland Cement Association.
Prepared Roofing Association.
Pyroxylin Plastics Manufacturers' Association.
Railroad Insurance Association.
South-Eastern Underwriters' Association.
St. Louis Fire Prevention Bureau.
Suburban Fire Insurance Exchange.
Tennessee Inspection Bureau.
Terminal Elevator Grain Merchants' Association.
Texas Inspection Bureau.
Texas State Fire Insurance Commission.
Underwriters' Association of the District of Columbia.
Underwriters' Association of the Middle Department.
Underwriters' Bureau of Middle and Southern States.
Underwriters' Bureau of New England.
Underwriters' Laboratories.
Underwriters' Service Association.
Union, The.
Washington Surveying and Rating Bureau.
Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Insurance Bureau.
Western Sprinklered Risk Association.
West Virginia Fire Underwriters' Association.
West Virginia Inspection Bureau.
Wisconsin Inspection Bureau.

Table of Contents.

WILLIAM H. MERRILL ..... FRONTISPIECE

EDITORIALS 101

A PADLOCKED PANIC BOLT. *Photograph* 107

FOREST FIRE CONTROL PROBLEMS AND PROGRESS. *Roy Headley* 108

THE PROTECTION OF FOREST LANDS 118

ENFORCING "NO SMOKING" RULES. *George W. Elliot* 121

BOY SCOUTS IN FIRE PREVENTION. *James E. West* 124

THE FALLACY OF PER CAPITA LOSS FIGURES. *Charles E. Worthington* 130

FIRE PROTECTION OF S.S. "LEVIATHAN". *A. J. Smith* 135

SAFEGUARDING DOMESTIC OIL BURNERS. *Curtis R. Welborn* 142

PROMOTING WATER WORKS FOR FIRE PROTECTION. *Ralph R. Silver* 149

THE CANAAN CONFLAGRATION. *Gorham Dana* 156

AUTOMATIC SPRINKLER TESTS. *Tennessee Inspection Bureau* 159

FIGHTING FIRE IN A CARGO OF SISAL 162

RURAL FIRE PROTECTION IN BRUNSWICK, MAINE. *S. E. Conner* 166

A FIRE ENGINE FOR FARMERS. *William Draper Brinckloe* 168

THE SUVA CONFLAGRATION 171

HAZARDS OF THE MEAT PACKING INDUSTRY. *George L. Raymer* 173

Department of Fire Record.

PACKING HOUSES—FIRE RECORD 178

THE WEST ST. WAREHOUSE FIRE, NEW YORK. *New York Board of Fire Underwriters* 186

OFFICE BUILDINGS—FIRE RECORD 189

FIRES IN WHICH THERE WAS LOSS OF LIFE 195

Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

William Henry Merrill

Secretary 1903-09 President 1910-1912

Fix it so it can't; then it won't.—*Willis O. Robb.*

The Quarterly

Vol. 17 October, 1923 No. 2

The Passing of W. H. Merrill.

The news of the death in Chicago on September 17 of William H. Merrill came with startling suddenness to the host of admirers of this unusual man. No public announcement had been made of his month's serious illness in which there were days when his recovery seemed hopeful to the little group of friends who were aware of the sudden stroke he had suffered. For over a year he had been afflicted with a complication of ailments which caused him considerable pain, and he was away from his office on an outing in the Wisconsin woods when a sudden and serious attack brought him back to the Chicago hospital in which he died. He was buried in Warsaw, N. Y., his birthplace, to which little city his body was accompanied by several of his friends and associates for many years, among whom were Dana Pierce, W. E. Mallalieu, A. R. Small, Franklin H. Wentworth, W. G. Allen, George B. Muldaur, D. B. Anderson, and G. T. Bunker.

The great service of Mr. Merrill to the N. F. P. A. will never be forgotten by the members who were interested in the organization during those formative years from 1903 to 1909 in which he was secretary-treasurer. His tremendous energy, his imagination, his persuasive eloquence and his unexcelled executive talent carried the Association's influence into broadening fields along with the development of the great Laboratories' organization which is the conspicuous accomplishment of his genius. No one who ever met him either in business or society escaped the indelible impression made by his unique and forceful personality, and everyone who had the privilege of his friendship will treasure the memory of it. The letters that have come to the Executive Office from members of the N. F. P. A. receiving notice of his death are vouchers of a wider and deeper appreciation of his character and talents than comes to most successful men. He still had work to do: ideas to develop: friends to

cheer and encourage: but the great organization he created will continue to function through other men, men who could not be associated with him without reflecting those high ideals of work and service which inspired in his associates such notable loyalty to their chief.

* * * * *

A New Class of Membership?

There is at present no engineering society exclusively for fire protection engineers. Almost every other class of engineering is now represented by its own separate technical body. The importance and value of societies of this sort are demonstrated by the work of the several well recognized engineering societies now in existence.

The N. F. P. A. has served as a technical society for fire protection engineers, but because of the fact that N. F. P. A. membership has been open to every other individual interested in fire protection, such membership has never carried with it any voucher of technical competence or engineering experience.

It is believed by certain of our members that the major benefits of a fire protection engineering society might be secured by establishing a class of technical membership in the N. F. P. A. and it is suggested that this matter be brought before the Association for discussion at the next annual meeting. Such special recognition by the Association of its technically expert members should enhance the dignity of the fire protection engineering profession and assist in establishing the reputable standing of the individual engineer. The new class of members should in turn add to the reputation and standing of the Association, giving it a setting as a recognized technical society which cannot be enjoyed while our technical men are merged with the non-technical. None of the advantages of our present organization need be lost, our organization and associate classes of membership remaining as they are.

An unestimated proportion of our present associate membership would be eligible to the proposed new class. These might be immediately transferred on examination or demonstration of their technical qualifications. Such qualifications might be passed upon by a committee on admission composed of members of high standing in the fire protection engineering field. To such a committee most of the first candidates for admission to the technical class would be personally known and the task of passing upon applications made thus relatively easy.

Whatever merit may reside in this suggestion for the establishment of a technical membership, it is at any rate a matter the Association may very well discuss and the officers are in favor of its presentation at the Atlantic City meeting next May.

Another Personal Liability Case. The West Virginia Court of Appeals has recently rendered an important decision on the liability of an employer for neglect on the part of an employee which causes fire. The ruling was made in the case of the Keyser Canning Co. vs. the Kloz Throwing Co., silk throwsters and dyers, and in part is as follows:

> The law requires the occupant of premises to exercise reasonable care to protect this building from fire and to prevent the spread of fire therefrom to the premises of his neighbor; and the presence of a mischievous or disobedient human being upon the occupant's premises, who the occupant knows may likely cause a fire which may be communicated to his neighbor's property, may constitute a danger against which the law requires the occupant to guard his neighbor.
>
> A silk manufacturing company conducted its business in a wooden building, amid highly inflammable surroundings; it had in its employ a young man known to be a smoker of cigarettes, knew of the dangers of fire from that source and repeatedly warned him against smoking upon its premises; the company permitted him after his hours of service were ended to sleep nights in the premises, notwithstanding the fact that it had full knowledge that he was continuing his habit of smoking and was disobedient to instructions, but took no further steps to prevent it; a fire was caused by the employee negligently throwing a lighted cigarette stub into a waste basket on defendant's premises, and it spread to and destroyed his neighbor's property. The silk manufacturing company is liable to its neighbor for its loss, though the employee was not actually performing service for it at the time of his negligent act and in furtherance of its business.

It is in court decisions like this that we are beginning to see the effects of our educational efforts to create a public opinion that shall regard the man who has a preventable fire as a social offender instead of an object of sympathy.

* * * * *

The Code Napoleon in Louisiana. An interesting item has been disclosed by correspondence with Mr. Lloyd Adams, secretary of the Fire Prevention Committee of the New Orleans Association of Commerce. Mr. Adams' committee is considering a bill for introduction in the Louisiana legislature fixing the cost of extinguishing fires upon persons disregarding fire prevention orders. In respect to the N. F. P. A. publications sent him on this subject Mr. Adams writes:

> In looking over the pamphlet which you sent us relative to personal liability for property damage due to fire, I was particularly interested in the article on page 12, "Individual Responsibility for Fires in France." Reference is made in this article to two sections of the Code Napoleon.
>
> As you are doubtless aware, Louisiana is the only State in the Union which adheres to the Code Napoleon in its civil practice. This fact caused me to look up our code and see if there were any articles dealing with the subject mentioned.

Article 2315 is almost a verbatim repetition of Article 1382 quoted in the pamphlet. The same applied to our Article 2316 as compared with Article 1383 of the pamphlet.

This gives us a decided advantage at the outset in our attempt to make individuals personally liable for fires caused by sheer carelessness.

The burning of the fascinating old French opera house, and the gradual elimination of the old buildings of the French quarter by the expansion of New Orleans business, will soon make it easy for casual visitors to forget that Louisiana was once a possession of France. The French names will, however, survive, and so will many old customs and statutes of which this discovered by Mr. Adams is one of especial interest to us.

* * * * *

The Gun-cotton Film in Hospitals.

There is a hazard developing in connection with the use of nitro-cellulose film in a field quite outside that of the much-discussed motion picture industry. The storage of film for X-ray pictures in hospitals is giving considerable concern to those interested in safeguarding these institutions. A few months ago some film stored in a basement room of the Boston City Hospital was ignited presumably from contact with an electric light bulb. Very fortunately this basement was provided with automatic sprinkler protection and the sprinklers extinguished the fire which otherwise would have endangered the many patients on the floors above. Quite another story is true of the fire from this hazard which occurred in the Crouse Irving Hospital at Syracuse last month. In this hospital the X-ray department was located on the first floor, occupying a pair of rooms, with closets and old bathroom space separating the rooms, and a similar room across the hall for film developing.

The exposed completed negatives, some 2,000, were stored on 12 inch wooden shelves in one closet and on similar shelves in an adjoining recess without a door, and on three open racks in the operating room itself.

Fire was discovered by a nurse who notified the doctor in the adjoining room. He immediately came in, opened the closet door, saw the fire burning along the edge of the lowest shelf, obtained a 2½ gallon soda-acid extinguisher, and played it on the flames, but without effect, as in about one minute an explosion occurred which threw him about fifteen feet across the room and set fire to the nurse's clothing and hair. This was extinguished by the doctor who then immediately shut the door to the operating room and turned in the fire alarm. Two trucks, three engines, and one combination responded, and were followed by a full response for general alarm. The firemen controlled the fire itself within a

short time. Prior to this, however, a second explosion occurred, blowing out the windows in the rooms above the X-ray department and bulging the partition to the storage closet in the X-ray department about a foot and a half. This was caused by the gas going in through ventilators and blind space, down into hollow partitions and up through to the second floor, igniting when it obtained the proper mixture.

No lives were lost, but a large number of patients were carried out of the hospital in anticipation of the possible destruction of the building.

The slow burning film being quite the equal of the gun-cotton film photographically, there is no excuse for the presence of this dangerous stuff where the sick and crippled are cared for; there is no excuse for its use anywhere except that it costs less money than the safety film. With the growing use of X-ray photography must we now begin another campaign of education and legislation to safeguard, under new conditions, human life from this old enemy? The Fire Marshals' Association of North America is certainly to be commended for its efforts to secure congressional action outlawing this film from interstate commerce. If it cannot be transported it will not be used; it will travel the road of the poisonous sulphur match, as it should.

* * * * *

Leather Charring and Burning Points.

James Kemp (member N. F. P. A.), District Officer of the William Street Fire Station, Melbourne, Australia, encountering a fire loss on sole leather, wrote us recently for information as to the temperature at which sole leather which has not had very much oil worked into it will char, and at what temperature it will burn. Being unable to find any authority on this subject, William D. Milne, Chairman of the N. F. P. A. Committee on Manufacturing Risks and Special Hazards, sought assistance from a New England leather manufacturer, who cooperated in making some simple tests at his factory. It was agreed that the charring and burning points will vary for differently tanned leathers, the amounts of variation only to be determined by extensive tests.

For the tests, small samples of sole leather of the combination or "Union" tan was used. This consists of leather tanned with both oak and hemlock tannin, being the most popular of the various sole leathers.

Small pieces were suspended in an asbestos cup under which were placed Bunsen burners and the temperature was gradually raised. A slight charring was noted at 160° C. (320° F.) consisting of a discoloration of the leather but with no incandescence. Temperature was raised on a steady curve to 360° C. (680° F.) at which temperature the leather did not burn nor show incandescence. What gases given off were not inflam-

mable. On removing the leather, the ends nearest the heat were found to be reduced practically to carbon.

A second test was then attempted, placing small pieces of similar leather in a platinum cup to which was applied heat from a Bunsen burner. A considerable period elapsed even with the cup red hot before the pieces of leather started to turn black. Finally a flame was secured from the leather, but with the removal of the gas burner this flame immediately went out. The estimated temperature was about 1600° F. Repeated application of the gas flame to the cup would produce a slight flame from the leather, but this vanished soon after the flame was removed from the cup, indicating clearly the necessity of outside heat to produce continuous burning of the leather. At the conclusion of this test, the pieces of leather were removed from the cup and these glowed red for a few seconds, then turned black. Each piece had increased in size but had held practically its original shape.

Fires in leather have been observed in which the edges of the sheets near the blaze were badly charred but the inside of the pile apparently unharmed. Leather men always claim that severe heat is injurious to leather but it has its salvage value nevertheless.

* * * * *

Philadelphia Murder Indictments.

Those who have noted with concern the part which the crime of arson plays in our annual fire loss, and the apparent ease with which this type of criminal often escapes punishment, will be especially interested in the aftermath of the North American Street, Philadelphia, warehouse fire of October 5, 1922, in which four firemen were killed. After the fire, Fire Marshal Elliott (member N. F. P. A.) found every evidence of arson with intent to collect insurance fraudulently, and brought evidence to this effect before the coroner.

The three men involved were at liberty on bail until the July Grand Jury returned indictments of murder against them, when they were rearrested. No trial has yet been held, but it is to be hoped that when the case is finally reached on the court calendar the trial will receive murder case publicity, for if the incendiary can be made to realize that in addition to the legal penalties for arson he will be held for murder if lives are lost in the fire which he starts, an important step forward will have been taken in the fight to reduce incendiary fire losses.

This picture shows what was found during a high school inspection by a state fire prevention association in the middle west. Every exit door on the building was similarly arranged and the padlocks were not unfastened during school hours.

Defective installation of panic bolts had so irritated the authorities that they padlocked the handles to the top of the door arch with heavy iron hooks. Just as effective as nailing the doors shut.

Are the exits of your school safe and unobstructed?

—Courtesy of Richard E. Vernor (Member N. F. P. A.), editor of *The Fire Plug.*

Forest Fire Control Problems and Progress.

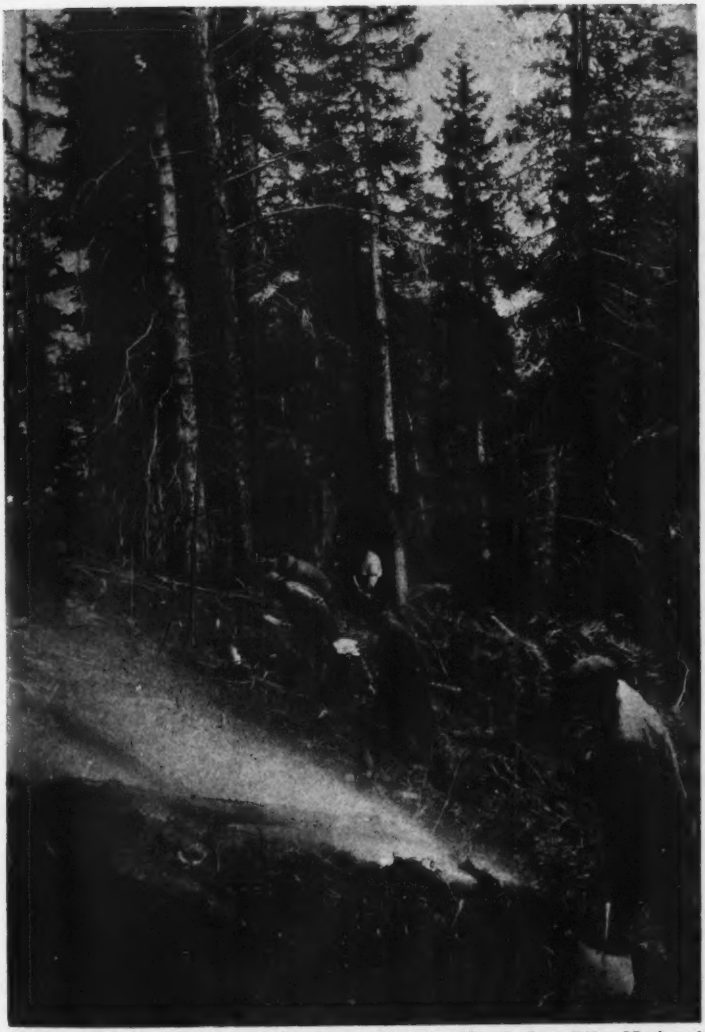
By Roy Headley, Assistant Forester, U. S. Forest Service.

When a fire occurs in a city there are clanging bells, speeding fire trucks, excitement and men working at high tension usually for short periods. When a fire occurs in a forest the resulting action may seem relatively slow and indifferent. A single man on horseback, leading a pack horse loaded with tools, supplies and bedding, may be seen traveling at a walk over mountain trails in the direction of the fire or winding his way through trees, brush and windfalls after he has had to leave the trail which goes nearest the fire. When roads are available and automobiles or trucks can be used for transportation, the rate of speed is more likely to be ten than thirty miles per hour because mountain roads are not built for speed. When large numbers of laborers have to be employed for fire fighting, they often have to be sent on foot to fires and in some of the remote National Forests their painful journey from the nearest rail or wagon road may require days or even a week. One of the sources of both pain and humor in forest fire control is that despite the efforts made to prevent it, laborers will occasionally try to make these foot journeys in light street shoes, high heeled riding boots or other such footgear even including rubber boots, all of which are totally unsuited to mountain side or trail.

In many regions a forest fire is not a matter of a short decisive fight, but requires weeks during which the fire is deadened for only a few feet in from the outside edge of the burned area and over which barrier a wind may easily throw sparks from the burning logs, stumps or snags inside the fire area. In many places a fire even after being controlled must be carefully guarded until rain occurs in the fall.

The differences between city and forest fire control are so great that one might think there is no relation between them. This, however, would be a superficial and wholly erroneous view. The fact is that the underlying principles and essentials of method are identical. Forest fire control has been driven to adopt the same general methods which experience has shown are necessary to protect from fire in cities.

The best handled fire in both city and forest is the one which does not occur. Over 60 per cent of all fires in the National Forests are man-caused and practically all of them are preventable. During the last five years on the National Forests 19,168 fires have been caused by human



1. Trenching a fire line at the South Boulder Creek fire, Pike National Forest, Colorado.

agencies. This is 62 per cent of the total number of fires in that period, the remainder being started by lightning. It is obviously useless to grow timber and care for timber land unless the timber is harvested and the forested land is used in the multitude of ways in which forests can be of value in the social and economic life of the nation. But harvesting and use means logging machinery and crews of men in the woods, not only during the season of abundant moisture, but necessarily during the driest periods of the year. Proper and desirable recreational use of the forests draws millions of travelers on roads and trails and sends hunters and campers and fishermen into the most remote spots regardless of fire hazard.

While all this use of the woods is desirable, it creates the greater part of the danger with which fire control has to deal. If all users of the woods realized the menace of fire and habitually took proper precautions in its use, man-caused fires in the next five years would drop to a few thousand resulting from unavoidable accidents instead of reaching the total of the last five years. To inform the general public of the menace of fire and to establish habits of care in its use is then the first objective in forest fire control just as it is in city fire problems. The Forest Service must try to "sell" the idea of care with fire to every possible user of the woods—which means practically the entire population of the United States, because even the residents of the great prairie states of the Middle West are thronging in increasing numbers to the nearest National Forest for rest and recreation. People of Eastern cities and towns are responding more every year to the impulse to spend their vacations and holidays in the nearest timbered land, which while usually not owned by the Government is as important for production of the nation's timber supply as though it were the property of the public.

Every available agency is used which can be drawn into the educational campaign. Newspapers and magazines co-operate willingly and carry every year thousands of columns of material dealing with fire. Organizations of business men, women, boys and girls, professional men and women, all have a part to play and respond readily. Signs along roads and trails are extensively used. Tons of printed matter are distributed annually and in this distribution summer hotels, sporting goods houses, and business houses generally give important aid by handing leaflets to customers or placing printed slips in packages. Maps and printed matter of interest to travelers are in great demand and these are made to carry a message about fire. Lantern slides and educational films are distributed for use in schools and theaters. Educational work in schools is regarded as particularly important because complete success in planting the idea of care with fire can only come by reaching the next generation.

One of the most important means which has been found for spreading the idea of care with fire is vigorous enforcement of the Federal and State laws on the subject. For many years it was believed that it was impracticable to secure evidence necessary to conviction for violation of fire laws. Various expedients were tried including the employment of trained detectives, but without success. Out of the pressure for finding some method of holding in check the ever increasing number of man-caused fires was born the idea of attempting to graft something of the knowledge and skill of the criminal investigator on to the knowledge of fire and woodcraft possessed by the average forest officer. This plan has proved a pronounced success. Training conferences have been held where Forest Rangers with the most aptitude for criminal investigation and collection of evidence have pooled their knowledge and learned all they could from men trained in other law enforcement fields. These selected men then carried the message to a wider circle of Forest officers with the result that violators of fire laws have been apprehended and convicted in increasing numbers. It is now clear that it is not materially more difficult to collect the evidence necessary to secure conviction in fire cases than it is in other such fields. All that was necessary was to find out just how to go about it.

The difficulty in general educational work in connection with fire is that the field is so much greater than the available resources in men, money and material to work with. If forest fire control could only once get ahead of its task by doing more along educational lines and less in fighting fires caused by lack of public education on the subject, the net results would be far better.

In forests as in cities fires will always occur even if educational work in the use of fire is 100 per cent successful. In both fields, therefore, fire fighting personnel and equipment must be selected and so managed that when fires do occur they will be suppressed with the least possible loss and expenditure for fire fighting activities.

Speed in Reaching Fires.

When one compares the dramatic rush of the city fire truck from its station to the scene of the fire with the laborious travel of a forest fire fighter from his station to a forest fire, there does not seem to be much similarity so far as speed is concerned. The fact is, however, that the outstanding lesson of 19 years' work in forest fire control is the importance of clipping minutes from the time which must elapse between the start of the fire and the arrival of one or more men properly equipped to suppress it. Careful studies of fire records on representative National Forests in California have shown that since 1913 the percentage of fires reached within one hour after starting has varied from 50 per cent to

20 per cent and that the curve of losses on account of fire has a direct relation to the number of fires reached within one hour.

The ideal is to reach any fire within an hour after its start, but this ideal is not within reach with the present resources in men and money. Two-thirds of the man-caused fires on typical National Forests in California, over a period of seven years, have not been reached within an hour. A small percentage were not even reached within 12 hours.

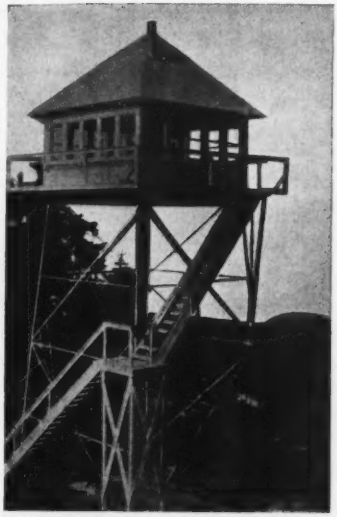
When it is realized that there are roughly 2,200 fire guards employed on the National Forests each fire season and that on the average each one of these has to cover nearly 40,000 acres, it will be understood that a good many fires can not be reached within one hour. Forty thousand acres is a tract nearly eight miles square. That does not make a great distance for a man to cover if he starts from the center to go to a fire on the outside of his unit, but it must be remembered that these are not ordinary miles. They include the roughest kind of country and are seldom traversed by roads or trails which lead near the point a man wishes to reach when going to a fire—particularly a lightning fire.

Darkness interferes greatly with travel to fires which start late in the day. Forest officers are required to start immediately upon receipt of an alarm and go as far as possible without delay; but when trails have to be left and rough timbered land has to be traversed, it often becomes impossible to make headway after darkness falls, even with the aid of artificial lights with which Forest officers are equipped.

Mountain Lookout Stations.

As in city fire control, the beginning of any effective system is some means of prompt discovery and report of the location of the fire to the proper men who should go to any particular fire. The essentials to prompt detection and report in Forest work are lookouts, lookout equipment, telephone lines, keeping someone constantly on duty to receive reports, and last but not least the maintenance of a morale or zest for the work which will keep lookout men and others on their toes.

Detection and reporting methods, like all other features of forest fire control, vary enormously under the wide range of conditions on National Forests and the large area of privately owned timberland, but in the typical National Forest, lookout men are stationed either on towers or mountain peaks which command the best view. Because the topography is usually rough no set of lookout peaks can be found which will afford a direct view of every point of the area covered. From three to eight peaks are ordinarily occupied for lookout purposes on a National Forest of a million acres. A good deal of systematic work is usually necessary to select peaks which will give the best results in detection for the funds available for wages of lookout men and investment in equipment. From

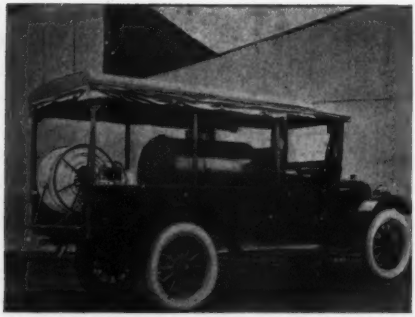


2. Typical looking station at Shasta National Forest, California.

each peak under consideration maps are usually made on which is shown by shading the areas into which a direct view can be had, and those which are hidden by ridges or other topographical obstructions. A great advantage is gained when an area is covered by two peaks. This permits direction readings to be taken on a fire from more than one lookout peak and when these readings are plotted on a map the intersection of the lines gives the exact location of the fire. Lightning fires in dense timber often give off but little smoke for days after the fire has started, and it is particularly important in such cases to be able to send fire fighters to the exact spot where the fire has started. Fire fighters often search for days for smoldering fires which can be seen intermittently from lookout peaks but which can not be located on the ground unless the men have the good fortune to stumble on them or know exactly where to go with reference to topographic features or land survey corners.

In the center of each lookout cabin is placed a table on which a map is mounted and oriented by reference to other peaks or features of known location on the map. On this map, surrounding the point at which the lookout peak is located, is drawn a circle which is divided into 360 parts with each division numbered so that the bearing of a fire from the lookout peak can be readily reported. The bearing is determined by placing an alidade (the working part of a surveying instrument) so that its edge is against the point at which the lookout peak is shown on the map. By looking through the sights of the alidade, the lookout man can bring his instrument directly to bear on the fire after which the direction of the fire can be read by noting the number on the circle which is closest to the intersection of the edge of the alidade with the circle.

A limited number of lookout peaks are equipped with more elaborate instruments for locating fires. The Osborne fire finder used in the Northwest not only enables the precise bearing of a fire to be read, but by the use of a device for measuring vertical angles enables the distance from the lookout peak to the fire to be determined with a considerable degree of accuracy. This is extremely important when "cross shots"



3. Protective equipment used at the Olympic National Forest, Washington.

can not be secured from two lookouts in order to determine the distance as well as the direction of a fire from the lookouts.

The combination observatory and living quarters provided for lookout men whenever finances permit, is a structure 14 x 14 feet square with a "ribbon" of glass on all four sides consisting of windows set as closely together as can be done without weakening the structure too much to stand the high wind pressure at the high elevations of lookout peaks. These windows are of sufficient height so that from any standing or sitting position within the building the lookout man can see out at any angle which is necessary to command a view of the country for which he is responsible. One result of this form of construction is that the lookout man can be on duty day and night except when asleep. He is on constant duty not because he is employed to work 16 hours a day, but because he can see his territory from any position in the cabin and the psychology of the job is such that a qualified man who has caught the spirit of the thing cannot help looking for fire, and in fact does so more or less unconsciously. When lookout houses of this standard type of construction are erected, the lookout men are required to live as well as work in them. Their water supply is even packed to them by other forest officers, although sometimes when the distance to water is not too great the lookout man is permitted to leave his station on the top of the peak for an hour or two in the morning in order to pack up the water he needs for the day from the nearest stream or spring.

Telephone lines connect the lookout man with someone who is designated to receive reports of fires. This man is usually called a dispatcher or central plotting agent. There may be a dispatcher for each Ranger District, but when communication by telephone is not slowed down too much by unreliable connections a single man is likely to serve as dispatcher for an entire forest.

The United States Forest Service has developed a type of telephone construction which is particularly well suited to forest conditions. Single wire or grounded circuits are ordinarily used. No. 9 wire has given the best results. This wire is not strung tightly on poles, as in ordinary telephone construction, but is loosely hung on trees. Staples

are driven in trees when available and the line wire is connected with the staples by from one to three feet of tie-wire. The line wire is prevented from grounding by use of what are called "split tree insulators" which are simply porcelain insulators resembling roughly a doughnut cut into two equal parts which are fitted together around the line wire and then held together by drawing the tie-wire tightly around a groove in the outside of the insulator.

When the dispatcher receives a message from a lookout man that a fire has occurred on a line with a certain bearing from the lookout peak, he calls another lookout man to get a "cross shot" if possible and thus locate the fire by triangulation. After having determined exactly or approximately the location of the fire, he decides what fire guards or other help should be sent, incidentally deciding how many men are required to handle the reported fire. He issues the necessary instructions over the telephone and if necessary calls up the nearest storekeeper and directs him to send immediately to the fire the groceries included in a carefully prepared list previously filed with the storekeeper.

Airplanes for Forest Fire Detection.

Aerial patrol has been tried on the Pacific Coast for a period of four years. The results indicate that observations from airplanes are not to be relied on for detection of fires. An excellent view of the country crossed is obtained from an airplane, but adequate fire detection must be continuous in order to be effective. With two aerial patrols per day a given spot in a forest will be under observation for two periods of from 15 to 30 minutes each. If smoke happens to show up while the aerial observer is looking at that point on the terrain, the best kind of detection service can be given if, as has been done, wireless receiving sets are scattered through the forest to receive the alarm sent by the aerial observer with his wireless sending equipment.

If, however, the smoke does not show up until after the airplane has passed, it will not be discovered from the air until the next trip is made which may be from six to eighteen hours later. This is altogether too slow, and the present opinion of fire control experts is that satisfactory detection can only be secured from stationary lookouts on towers or mountain peaks. This method of detection may be supplemented by aerial observation with excellent results. One of the probable developments of the use of airplanes in fire control is in connection with lightning fires which often smolder for days after being set and during this period do not give off enough smoke to permit detection by stationary lookout men on mountain peaks. It is only a matter of time until airplanes will be used after electrical storms to search out the fires

which have not given off enough smoke to be observed from lookout stations on the ground or which are hidden for a time from the stationary lookout man by intervening ridges.

Present plans contemplate just such a use of airplanes in the fire season of 1924. If Congress provides the necessary funds it is expected that the Air Service of the U. S. Army will co-operate with the Forest Service by stationing planes and pilots at selected places in the Western National Forests. This will be no new activity for the Air Service. Working under many discouraging conditions this division of the Army has rendered most excellent co-operation during four years prior to 1923.

If present plans are carried out in 1924, planes and pilots will be available to take Forest officers up for special examinations of country in which it is suspected that fires have been started which are not visible to the stationary lookout force. Lookout men on mountain peaks can work only at intervals when numerous fires are burning and a smoke blanket obscures their view for parts of days or even for days or weeks at a time. Airplanes are also extremely useful in making observations of a fire which has grown large and is difficult to reconnoitre from the ground.

Fire Fighting Methods.

Speed in getting away from the station is important in forest fire control just as it is in city fire work. While fire guards do not slide down a brass rail when called into action, they are often required to keep saddle and pack animals tied close at hand with saddles on and ready to go at a moment's notice. All fire guards are required to keep tools in perfect readiness for instant use and emergency rations for from one to three days must be in readiness so that when the alarm comes from the dispatcher, the fewest possible number of minutes will be required for the get away.

Transportation in fire control is determined by the availability and type of roads and trails. Where roads suitable for use by motors are available, automobiles or trucks are usually employed. Where only trails are available, horses must be depended upon. When the trails are too rough or too scarce, travel must be on foot. Sometimes horse feed is so difficult to secure for remote locations where no grass can be had, that foot travel must be the rule even over trails which horses could easily travel.

Congress has provided appropriations with which the road system is being extended for use in fire control. There will never be a time, however, when trails can be dispensed with. The cost of constructing and maintaining a road system which would make trails unnecessary would be prohibitive.

When one or more men arrive at a fire, the nature of the work done varies first of all with the size of the fire. Many fires can be handled by a single man. Many more are suppressed by from two to eight men. Other fires will not yield to anything less than the efforts of from 500 to 1,000 men before the fight is over. To assemble, organize and direct several hundred men on a fire line where conditions are likely to change every hour, is obviously an enormously difficult problem in emergency organization and management of men, equipment and supplies. On the other hand, the man engaged in suppressing a one man fire has no difficulty in managing the job. If he possesses a reasonable degree of skill and experience, he will have no nerve-racking decisions to make as regards the management of the job. His body is likely to be racked, however, with the exhausting toil which must be kept up without pause until the fire is under control. He often cannot stop even to eat or go for water for fear the fire will develop sudden strength and make a run reaching proportions which he can not handle without help.

A fire in a city is fought without rest until no living spark can possibly be left anywhere. This is usually an utter impossibility in forest fires, particularly large fires. The immediate purpose in fighting a forest fire is not to extinguish it, but to deaden its edge. After this has been done the fire fighters will work progressively in from the deadened edge toward the heart of the fire smothering or extinguishing fires which would otherwise burn for days or weeks in logs, stumps and snags. It is seldom, however, that more than a few rods inward from the edge of the fire is worked upon by the fire fighters. The interior of the fire is allowed to burn itself out.

Although forest fires have been fought since the Pilgrims landed and stepped from Plymouth Rock into the woods, systematic fire control is a comparatively new thing. Practically all the technique now developed has grown up since 1910, during which season so many lives and so much forest property were destroyed in the Western States. Fire control in America has been able to learn practically nothing from experience in other countries. The regions in which forestry has been most highly developed are not subject to the same fire danger as American timberland. Twenty years from now the knowledge and practice of 1923 will seem extremely crude. American foresters have whatever satisfaction is to be derived from knowing that they are doing pioneer work in a field which is essential to the production of the timber supply indispensable to the social and economic welfare of the nation.

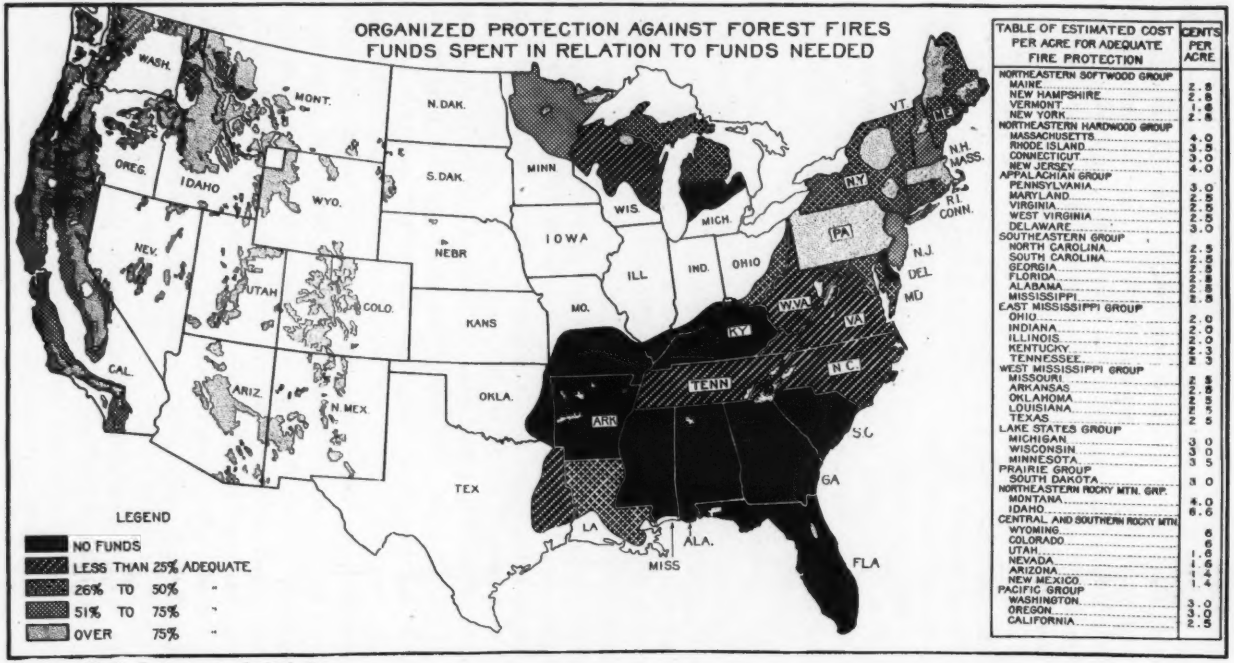


TABLE OF ESTIMATED COST PER ACRE FOR ADEQUATE FIRE PROTECTION	CENTS PER ACRE
NORTHEASTERN SOFTWOOD GROUP	
MAINE	2.8
NEW HAMPSHIRE	2.8
VERMONT	1.6
NEW YORK	2.8
NORTHEASTERN HARDWOOD GROUP	
MASSACHUSETTS	4.0
RHODE ISLAND	3.5
CONNECTICUT	3.0
NEW JERSEY	4.0
APPALACHIAN GROUP	
PENNSYLVANIA	3.0
MARYLAND	2.5
VIRGINIA	2.5
WEST VIRGINIA	2.5
DELAWARE	3.0
SOUTHEASTERN GROUP	
NORTH CAROLINA	2.5
SOUTH CAROLINA	2.5
GEORGIA	2.5
FLORIDA	2.5
ALABAMA	2.5
MISSISSIPPI	2.5
EAST MISSISSIPPI GROUP	
OHIO	2.0
INDIANA	2.0
ILLINOIS	2.0
KENTUCKY	2.3
TENNESSEE	2 3
WEST MISSISSIPPI GROUP	
MISSOURI	2.5
ARKANSAS	2.5
OKLAHOMA	2.5
LOUISIANA	2.5
TEXAS	2 5
LAKE STATES GROUP	
MICHIGAN	3 0
WISCONSIN	3.0
MINNESOTA	3 5
PRAIRIE GROUP	
SOUTH DAKOTA	3 0
NORTHEASTERN ROCKY MTN. GRP.	
MONTANA	4.0
IDAHO	6.6
CENTRAL AND SOUTHERN ROCKY MTN.	
WYOMING	6
COLORADO	6
UTAH	1.6
NEVADA	1.6
ARIZONA	1.4
NEW MEXICO	1.4
PACIFIC GROUP	
WASHINGTON	3.0
OREGON	3.0
CALIFORNIA	2.5

Courtesy U. S. Department of Agriculture.

A little more than half of the forest area of the United States receives more or less adequate protection from fire. Twenty-seven states have organized protection and practically all Federal lands are protected.

The Protection of Forest Lands.*

About 54 per cent of the forest area in the United States receives more or less systematic and adequate protection from fire. This includes the 95 million acres in national and state forests, national parks, and Indian reservations, and around 160 million acres in private ownership. The national and state holdings are protected mainly by direct public appropriations; the private forest lands chiefly by federal and state agencies in co-operation with each other and, to a considerable degree, with the owners of the land.

Thirty-nine states contain important areas of forest land. Twenty-seven of them have organized state forest protection on a more or less adequate scale. Approximately $3,300,000 is now expended annually for the protection of the forest lands in private ownership, of which state appropriations or special taxes furnish $1,930,000, the Federal Government furnishes $400,000, and private land owners contribute $1,000,000 —an amount often increased during seasons of special hazard. At least 166 million acres of privately owned forest land on which systematic fire protection is the first essential step to continuous timber growth now receives no protection, and on many other areas the protection furnished is incomplete and inadequate. An average yearly expenditure of between 2.5 and 3 cents per acre, or a total of $9,250,000 would fairly protect all of the privately owned forest land in the United States. The task is at present two-thirds undone.

During the last six years an average of 33,500 forest fires has occurred annually, burning over more than 7 million acres of forest land. Fifty per cent or more of the total loss in 1921 occurred in the South, where eight states have no organized forest protection and the rest have wholly insufficient protection. Fire, which goes hand in hand with destructive logging, has through repeated burning of young trees been the chief means of keeping the forest growth in the United States so far below the current drain upon our timber. Moreover, it has been responsible primarily for the lowered productivity of immense areas of forest soil.

Notwithstanding the losses still incurred, forest protection has made enormous strides during the last 12 years. This is due largely to the general awakening of the country to its forest problem, including the

*Extracted from "Timber: Mine or Crop?" Bulletin No. 886 of the Forest Service of the U. S. Department of Agriculture.

realization by timber owners of the necessity of preserving their merchantable stumpage. It has been aided by the co-operation extended by the Federal Government in protecting the watersheds of navigable streams, which during this period has stimulated the efforts of 15 additional states and enlarged the area of private forest land receiving protection from 59 million to 160 million acres.

Forest fire protection still varies widely in efficacy and in methods of financial support. A majority of the states defray its cost chiefly by general appropriations; a few, like Maine and Louisiana, levy special taxes upon timber or forest land for the purpose; while others, notably Oregon and Washington, require the landowner to meet the expense of a fire patrol.

An Object Lesson.

(From a Recent Fire Report.)

A young woman employee in a shoe factory, engaged in cementing wood heels, preparatory to attaching leather covers, stopped to show one of the men employees her new engagement ring. The man thoughtlessly struck a match to light a cigar while examining the ring and the tray of freshly cement coated wood heels immediately caught fire.

In the excitement the ring was dropped into the blazing tray but was rescued by the young woman, who received painful burns about the hands, requiring hospital treatment.

Another employee extinguished the fire with sand before sufficient heat had generated to open the sprinklers.

Enforcing "No Smoking" Rules.

By George W. Elliott,
Fire Marshal, City of Philadelphia.
(Member N. F. P. A.)

Some years ago it was evident that a large number of fires were originating in Philadelphia from careless smokers. Carelessly thrown cigarettes and matches were decidedly increasing our annual fire losses. This was especially true in garages and manufacturing plants where inflammable material was used or stored and where employees were found to be smoking rather promiscuously or in common parlance, "stealing smokes".

An educational campaign was conducted in the hope of having the employees realize that the danger was theirs as well as that of their employers, and to that end a placard was widely distributed calling attention to the fact that smoking was dangerous and might cost all the employees their jobs if the building were destroyed by fire.

As this seemed to have very little effect, the employers were appealed to in an effort to break up the practice of smoking. In no case were the employers unwilling to assist, but found themselves seriously handicapped by the attitude of the workers who felt that their individual rights were being interfered with and resented the orders from the employers and the enforcement of the city's orders with respect to smoking. This attitude was carried to the extent of having the employees walk out in a body when one of their number was discharged for violation of the "no smoking" rule.

When it was evident that the effort of educating the employees was not going to accomplish much at once and that many fires would occur before they had sufficiently assimilated the idea underlying the "no smoking" rule, certain of the labor leaders were approached and the proposition discussed with them. The labor leaders were unanimous in declaring that no man should smoke where it endangered himself, the property, or the job involved. It was then apparent that neither the employer nor the labor leaders opposed this rule of "no smoking" when it was sensibly applied, and it was also obvious that pressure would have to be brought to bear upon the employees who insisted in violating what was deemed a sensible effort to prevent loss of life and property.

SMOKING IN THE PLANT

Kasmir Bartholomew, Clock No. 95, was caught smoking in the N. A. Plant on the night of July 27th.

On August 2nd, he was arrested by the Fire Marshal of the City of Philadelphia, on a charge of criminal carelessness.

On August 3rd, he was taken before a magistrate, who informed him that he was liable to a sentence of thirty days in jail, but for this offense he would be fined $25.00 plus $4.00 cost, totaling $29.00.

This was done by the City Officials to protect you, your family and your job, and to make this plant a safe place for you to work.

The carrying of matches and smoking in the plant is a criminal offense. To smoke in the plant under any conditions is like looking for a gas leak with a lighted match. If while actually smoking nothing happens, there is no assurance that the butt when thrown away will not immediately cause disaster.

Cannot you see that in case of accident or fire, you and your family are the greatest losers? The Company is insured from all angles, but what can replace your life?

THE BARRETT COMPANY
FRANKFORD

S. P. MILLER,
Superintendent

August 8, 1923.

This notice, printed in three languages, was placed by the Barrett Company in every pay envelope on August 8, 1923. Smoking was effectively stopped.

In June, 1911, there was added to the statute books a law governing the elimination of fire causes, one of the sections of the Act stating that whenever the Fire Marshal or his inspectors find any building so occupied that fire would endanger persons or property therein or whenever any such officers find in any building or upon any premises conditions dangerous to the safety of such building or premises, they shall order the same to be removed or remedied, and such order will be forthwith complied with by the owner or the occupant of said building or premises. The penalty provided for infraction of the above is $25 and in default of such payment imprisonment in the county prison for not more than thirty days.

A careful study was made of the language of this Act and it was finally decided that under the language of the Act a person found smoking, after having been notified by the proper posting of notices and by proper communication from his employer, that smoking constituted a condition, considering the stock in the building, that was especially likely

to cause fire and would endanger persons or property therein, was violating the expressed meaning of the Act if he insisted in smoking.

Employers were notified of this conclusion and their aid was asked in notifying us immediately where any of the employees persisted in smoking after proper notice. At the same time several of our police magistrates were advised of the law and our conclusions regarding the meaning of the law where smoking constituted a danger, and we awaited results.

Shortly after this in one of our large factories an employee, after proper notice, was found smoking and when asked to stop he refused. The employers had been instructed that in such a case the names of those present should be noted as possible witnesses, the time, the hour and the conditions noted and the information given to the Fire Marshal's office. This was done in the case mentioned and the employee was allowed to go home that night as usual. When notification was received at the Fire Marshal's office a warrant was issued for his arrest, the warrant was served and he was taken before a magistrate and fined. Since that occurrence smoking has practically ceased in that particular plant.

More recently the practice of smoking was noticed among several employees in the plant of the Barrett Manufacturing Company and, as the officials of this company had been among the employers who had agreed to co-operate with this office, they notified us of the conditions and in turn were notified that at the first offence details should be sent to this office and, as in the previous case, the warrant was issued, the hearing held, and the offender fined $25 and costs. An appeal was made by the offender on the ground of hardship to his wife and children. The answer of the magistrate was that every other man in the factory was similarly situated and that the act of smoking, under such conditions, jeopardized the wage earner of every one of the families involved as well as the property of the employer and that for the protection of all he felt that he was obliged to apply the legal penalty.

Following this, the employees of the entire plant received notices in their pay envelopes in three languages setting forth the conditions briefly. This seems to have ended the practice of smoking in this plant.

The employees in these cases were not discharged, as it seems to be sufficient punishment, in itself, that they subsequently are taken before a magistrate. They can later be discharged if it is seen fit, the point made being that the penalty stands as imposed for a violation of an Act of Assembly, having nothing to do with whether the employee is continued in employment or not.

This practice will be continued until the habit of smoking in dangerous places in Philadelphia is entirely eliminated so far as it is possible to bring it about.

Boy Scouts in Fire Prevention.

By James E. West,
Chief Scout Executive, Boy Scouts of America.

Every normal boy loves a fire. It is a race between him and the fire engine to arrive first on the scene of action. He gets in every one's way, entangles himself in equipment and wriggles up to every vantage point he can attain.

Some time ago a few wise persons conceived the idea of using the boy's innate love of enterprise, directing his generous eagerness to help, transforming him, in short, from a hanger-on into an active ally in the fight against the fire peril. It is hardly necessary to dwell upon the benefit it has been to the boy to have a chance to play in a man's game, to be of use where he formerly was only a nuisance. But it should be emphasized that of all the eager and unselfish and high-hearted devotion of which the human race is capable, a young boy furnishes perhaps the most shining example.

The Boy Scouts of America number nearly a half million boys, standing, human dynamos, shoulder to shoulder for fire prevention. An army for the cause, an army of eager, energetic lads, working to make our country a better and safer place to live in; a place where children will be protected, property more secure, and men and women more careful and thoughtful of the safety of others.

Every Boy Scout before he reaches second class rank has proved his ability to build and take care of a fire,—and to put it out. In the ordinary routine of his scouting, he has brought to his attention the usual safety precautions, and his general training enables him to act with resource and intelligence when occasion requires. But this general training is not enough to satisfy the ambitions of eager boyhood. That is why the Boy Scout Fireman came into existence.

The Boy Scout Fireman has been especially trained in principles of Firemanship and Safety First. His primary duty is to stop the fire before it happens. Every Boy Scout council in the United States may have a Firemanship Unit, many such units are now in existence and their number is constantly increasing. Boy Scout Firemen are the official aides of the fire departments in many of our larger cities. In smaller localities, where fire fighting facilities are limited, the value of the Boy Scouts' services is even greater.

A Fire Drill of the Newport, R. I., Boy Scouts.

The slogan of the Boy Scout Firemen is "Fight the Fire Fiend". Their purpose, as outlined in their constitution, is "to promote the safety of life and property by the prevention of fires and accidents". No less a hero than the chief of the city fire department is the chief of the Boy Scout Firemen Unit. Many a grizzled veteran of the fire department leaves his duties for an hour to give instruction in the principles of firemanship and fire prevention to a class of attentive Boy Scouts. The course of instruction covers several weeks and includes practical work as well as theoretical. The fire chief himself gives the examinations. The proud boy who successfully completes the work is entitled to wear a metal badge, a five pointed star bearing the inscription, "Scout Fireman", an insignia greatly prized by the boy. Membership in any one unit is limited to two hundred.

One of the most important things the Scout Fireman learns is that safety begins at home. Mother is urged to use an electric flashlight instead of a candle when rummaging in the clothes closet, and to refrain from using kerosene to kindle the kitchen fire. Dad receives a pamphlet giving statistics on the causes of fires, and discovers that putting hot ashes in a wooden barrel stands high on the list. Little sister is cautioned against throwing waste paper in the fireplace, and the Scout himself conducts an inspection of the gas and electric fixtures.

Then he considers his community. Are the buildings constructed in accordance with the fire laws? Are the fire escapes clear of obstacles? Are the hallways free from rubbish? Are inflammable liquids safely

kept in proper containers? The slim lad in khaki who tactfully tells the landlord of his shortcomings is a Scout Fireman. Many a fire never happened because a Scout Fireman saw the danger in time. A survey of his home and community is a regular part of his training.

The Scout Fireman understands fire extinguishers. How many average citizens can discriminate between soda-acid extinguishers, and those using carbon tetrachloride? How many are aware of the things which may interfere with the operation of an automatic sprinkler system and know how to correct them? Yet this information was not too technical for some eight thousand boys to master last year. They studied the water systems of their communities, the capacity, the pressure, the source of supply, safety rules, fire laws, and fire escapes.

All this by way of fire prevention. The Scout Fireman is not expected to work behind the fire lines. His task is to keep the crowd in order, give first aid if necessary, perform police duty, and assist the firemen in any way he can. But emergencies do arise. And the motto of the Boy Scouts is "Be Prepared." Here are the requirements of the Firemanship Merit Badge Pamphlet which every scout who wins his badge in Firemanship has met:

To obtain a merit badge for Firemanship a scout must

1. Know how to turn in an alarm of fire.
2. Know how to enter burning buildings.
3. Know how to prevent panics and the spread of fires.
4. Understand the use of hose—unrolling, joining-up, connecting to hydrant, use of nozzle, etc.
5. Understand the use of escapes, ladders, and chutes, and know the location of exits in buildings which he frequents.
6. Know how to improvise ropes and nets.
7. Explain what to do in case of panic, understand the fireman's lift, and drag, and how to work in fumes.
8. Understand the use of fire extinguishers; how to rescue animals; how to save property; how to organize a bucket brigade; how to aid the police in keeping back crowds.

Since 1917 over 30,000 Boy Scouts in every state in the union have learned how to prevent a fire from starting, how to keep it from spreading, and what to do in an emergency, as outlined in the above requirements.

The fire chief of Spokane, Wash., said last winter, "I wish to commend the Boy Scouts for the valuable work they have performed. The effective work done by these energetic and enthusiastic Scout Firemen has been an important factor in reducing fire hazards and fire losses."

Here is an example of the kind of service our Boy Scouts render. Some New York State Scouts were returning from a hike along the outskirts of a large estate. They noticed smoke coming from the roof

New York Boy Scouts practicing the fireman's lift at a drill in Central Park.

of a house. One of the boys ran to send an alarm to the fire department, and the others made for the building. They scrambled up to the roof (wall scaling is a scout accomplishment) and located the fire in a defective chimney flue. The fire department arrived promptly but the scouts had already put out the fire.

New Jersey boys recently prevented what might have been a serious disaster. Their camp site happened to be not far distant from a cabin used as a storehouse for dynamite used in an adjacent stone quarry. The scouts discovered a brush fire near the camp. The fire was rapidly burning its way toward the cabin and disaster was imminent. Some of the boys went ahead to check the fire by a back firing, the rest fell to beating the ground, with bags, coats, blankets and wet brooms. An hour's hard work saw the flames extinguished; a catastrophe had been averted.

The Boy Scout because of his training, his courage, and his cool head, is well qualified to avert a panic when the emergency comes. In a crowded room when the smell of smoke is noticed and people begin stirring uneasily, an injudicious cry of fire will bring a wild rush of alarm. In such cases a few excited people can turn a crowd into a mob, and a few calm people can prevent a panic. The Boy Scouts know what to do in such an emergency.

Training is something more than technical skill. It is quick wit, a cool head, disciplined muscles and the will to do. For example, a scout recently averted an ugly fire, and possible loss of life, when on his way home when he saw flames in his neighbor's kitchen. Dashing to the door he discovered that the oil stove had overturned. Nearby were gasolene and kerosene containers plainly marked. The scout held his breath and dived in. A moment more and he was out in the yard again with the containers safe and the danger of an explosion averted. The fire gained headway and a crowd of people gathered. But it was only the scout who had wit enough to run for a long ladder, organize a bucket brigade and direct the efforts that saved the property.

There is a Boy Scout slogan, "A Scout does at least one good turn every day." This must be some service great or small rendered in an unselfish spirit. Often a troop will undertake a piece of service together for the community. These "community good turns" are reported every now and then to National Headquarters, and very interesting reading they make. Those that have to do with fire service are of especial interest, and here are a few selected at random from a long list. Please bear in mind that many of these good turns were rendered not by the 30,000 specially trained scouts who wear a Merit Badge for Firemanship, but by the rank and file, if you please, of the half million boys.

"Cleared hydrant during winter. Directed traffic at fire." Newburgh, N. Y.

"Rendered real scout service during and after big fire. Every member of this troop answered the call." Astoria, Oregon.

"Fought a big fire and cleared wreckage of large dwelling house." Newtown, Ohio.

"Helped to put out a fire in a burning house. Gathered furniture for family burned out." Plainwell, Mich.

"Established fire lines and served hot coffee to firemen at a large factory fire in town on New Year's Eve from 2 P. M. till 1 A. M." Kenilworth, N. J.

"Put out 17 fires." Chicago, Ill.

"Fultonville school burned down. Helped teachers to get the children out of the burning building, some of the scouts getting slight burns performing this duty." Fultonville, N. Y.

"Saved cotton platform from fire. Detected and extinguished fire in building of a crowded section of state fair grounds." Forreston, Texas.

Boy Scouts and Forest Fires.

Nowhere perhaps are Boy Scouts better appreciated than in timber lands where their services in preventing and fighting fires have often saved thousands of dollars worth of property. In 1922 one hundred medals were awarded by the Pennsylvania State Department of Forestry to Boy Scouts for conspicuous service in forest protection. In Reading alone, three fire brigades have been formed. Two boys are equipped with compressed air extinguishers, two with axes and eight with rakes. Volunteer fire watchers keep a constant lookout at various points during the dry season. The Boy Scouts of Reading Park recently fought a particularly stubborn forest fire. In this section there are thousands of dead chestnut trees in the woods. If fire gets under the bark of these, it creeps to the top and burns for hours. With their faces protected by wet handkerchiefs, the boys fought flames higher than their heads, and pushed through a wall of smoke. They got control of the fire with their poles and sandbags. Afterwards came the important "clean up"

duty, stamping out the last sparks and embers. Scout leaders remained on guard duty throughout the night.

The Chief Forester of the U. S. Government said recently that the Butte, Montana, scouts "put on the best forest fire prevention campaign in the United States".

Here are a few instances of forest fire fighting selected at random from our good turn reports.

> "Two of our scouts put out a bad forest fire at grave danger to themselves and were complimented by the Ranger." Arcadia, Cal.
>
> "Put up forest fire prevention signs." South Hills, Pa. (That is a service rendered all over the country.)
>
> "Helped in fighting a very bad forest fire." Picture Rocks, Pa.
>
> "While in summer vacation camp, a brush fire started nearby by campers was extinguished by scouts. The community held a parade and fair for firemen's demonstration to get funds for the fire department. Scouts took active part in both." Los Angeles, Cal.
>
> "Put out forest fire in Rosedale woods first discovered by scoutmaster from New York while on the train." Brooklyn, N. Y.
>
> "Seventy-five hours fighting forest fires in five weeks last spring. Patrol leader led troop in extinguishing large forest fire." Carbondale, Pa.
>
> "Distributed cards, stickers and hangers for U. S. Forest Service." Anaconda, Mont.
>
> "Forest Fire Fighting Patrol organized. Has its special call. Cleared wood roads for forest fire apparatus." Dover, Mass.

All these incidents are duplicated literally by the hundred all over the country. It is safe to say that comparatively few of them are ever reported to our National Headquarters.

The Boy Scouts of America can mobilize quickly as an organized unit. They are well trained, efficient and eager to serve. The outline of the training and the examples of the wide variety of service mentioned above should give an idea of the practical results that our Boy Scouts of America are now accomplishing.

There is another aspect of this Boy Scout training that will occur to the thoughtful observer. The boys of today are the men of tomorrow. The Boy Scouts will come into their responsibilities as men with a practical knowledge of municipal and national affairs. Every Scout trained now will not only be a living advertisement for the principles of fire prevention and safety first, but he will feel it very distinctly his duty to see that the fire department functions properly. The man who as a boy inspected the fire escapes and hallways of his neighborhood will not allow the fire department to be handicapped by politics or insufficient funds. He will do more than require the latest and most scientific equipment; he will know personally why it is best adapted for his particular community.

All those interested in the cause of fire prevention should lend their assistance to these fine boys who are so earnestly trying to do their share. Encourage them. Help them. Give them leadership. Organize a troop. If you can't give as much time as you would like, at least give them what you can. Invest an hour, two hours a week in our boys. They need you and will repay you in a way that will make you feel it was the richest investment you ever made. National Headquarters, Boy Scouts of America, 200 Fifth Avenue, New York City, will be glad to send you all details.

Help the Boy Scouts of America to build the men of tomorrow, and take the first step in preventing tomorrow's fire, today.

The Fallacy of Per Capita Loss Figures.

By Charles E. Worthington.
(Member N. F. P. A.)

The increasing volume of fire loss in the United States and Canada has been the subject of much recent editorial lament. But is not this increase, or at least a substantial part of it, inevitable under present conditions?

For purposes of comparison, assume a community of 100 houses where under average conditions we might expect a certain definite fire loss each year. Compare this with another community similar in every way except that there are 500 houses instead of 100. In this village of 500 houses we should expect five times the fire loss of the village of 100 houses. If the population were the same in each case the per capita loss would be five times as great in the 500 house community as in the community with 100 houses. This difference between the two does not reflect upon the carefulness or fire prevention precautions of the village with the larger number of houses, for when fire losses are referred to total amount of property instead of to number of inhabitants, they are of the same relative amount in each case.

While this is a rather extreme example, it serves to illustrate the recent developments in the United States and Canada. We have been growing from the status of the community of 100 houses to that of the community of 500 houses, while our population has increased comparatively little. According to the United States Census Bureau, in 1920 the total wealth of the United States if pro-rated among the population would have given each individual a share of $2,800. Two years later, in 1922, the Census Bureau estimates that this share is $3,600, an increase in two

years of 30%. Assuming that in 1922 we burned our property at the same rate as in 1920, we would expect 30% more fire loss. As a matter of fact, statistics show that the increase in fire loss between 1920 and 1922 is only about 19%.

While this increase in wealth has been taking place very rapidly, the increase in population has been at a much slower rate, the normal increase in the United States being approximately 1½% annually. This is only one-tenth of the rate of increase in property.

The continued stressing of the "per capita" loss is misleading. The fire devil is black enough as he is, deeply, darkly, beautifully black, so black that he requires no coat of black paint to intensify his blackness except there be some good reason for covering and hiding the scattered spots where he may have been partially bleached. The per capita loss serves not as a measure of the ravages of the fire devil, but simply as an index of the average personal holdings of destructible property.

Let us consider the case of Italy, a country often cited for its low per capita loss. In 1920 the total value of Italian property was $35,500,000,000; of the United States $300,000,000,000. Assume, as a convenient figure, a uniform fire loss in both countries of ⅛ of 1% of its property. In such case the fire loss of Italy would have been $59,000,000; of the United States $500,000,000. In either case this is a tax on property, levied to cover the fire loss (naturally such a tax is on property because the destruction of property only was involved), and would call for an assessment on all property in both countries of ⅛ of 1% of each individual building.

Suppose this plan were abandoned and a sufficient head or poll tax (per capita) levied. The $59,000,000 Italian loss would be pro-rated in a population of 40,000,000 and the individual share, the "per capita", would have been $1.47. The American loss would have been apportioned among 107,000,000 and the individual share, the per capita, have been $4.72. That is to say the American per capita would figure almost 3⅓ times the Italian with an absolutely identical proportion of property sacrificed.

This is merely to illustrate the statistical worthlessness of per capita comparison of fire loss, of an attempt to measure it not by values exposed but by the number of separate owners. The assumption of ⅛ of 1% loss of course has no relation to actual figures, and the Italian losses assumed are much above actual recorded losses.

One wonders a little also whether in these comparisons with foreign losses (restricted as a rule to the very low percentages of Central, Northern and Western Europe), sufficient allowance is made for the different conditions prevailing in these countries.

The ancient code of Hamurabi II seems to contain no provision for the right of way for the fire department of Babylon (if there was any), but in a community where the only obtainable wood was that brought down at great cost from the head waters of the river or up from some remote coastal region, and was a luxury enjoyable only by the very rich, naturally its use was somewhat restricted.

Probably in Babylon the average citizen needed only some sort of a spade or shovel and a bucket for house building implements. He dug the material for his walls in his back yard and built with the aid of a few buckets of water from the convenient Euphrates, and the sun did the rest. His thatch was of the all but incombustible reeds from the same kindly source and a few pails of bitumen from the abundant pools of that useful material furnished cement. One can hardly imagine a conflagration sweeping the vast stretches of round huts of the old city, so little was the use of combustible material. Temples and palaces no doubt suffered to a greater extent but the main city was probably conflagration proof.

It is indeed a far cry from the ancient to the modern Babylons but the apology for this citation lies in the fact that somewhat similar conditions actually exist in some countries today. The dweller in the district about Aetna builds his walls of blocks of soft lava, so soft as to be quarried and shaped with little effort, but hardening in the air. Of wood he uses the minimum, for wood is very scarce and costly. Naturally the fire loss is low. This condition applies in many large districts and even where it does not the traditions of those people of Visigothic descent do not favor the use of structural wood beyond bare necessity and there are no shingle roofs.

This difference in building habits is due partly to conditions of environment and partly to racial proclivities, but the net result is, from the standpoint of fire hazard, beneficial. Fire grows by what it feeds upon and the growth is best stunted by starvation. In that respect it is like a living thing.

The less the chances of fire, the less the need of care in its avoidance, and with combustible material reduced to a minimum it may be assumed that the people in these countries have little inbred fire-carefulness, after many generations of existence under conditions where care with fire is unnecessary. What, then, is the result when these same people are transplanted by immigration to North America?

Arrived in America, the foreign element naturally seeks companionship of those speaking its own tongue and segregates in districts, preserving as far as the new environment permits the personal habits and habits of thought of the country of origin. In one of these segregated

districts an American can sometimes easily imagine himself in another country. The difficulty of adjustment to new conditions seems somewhat proportioned to the intelligence of the immigrant. Mere transfer from one environment to another can not be expected to work any mental change, for the thoughts and habits of adults are fairly well fixed and the greater the average age and the less the education, the less the mental flexibility. These people are partly unable to comprehend easily new ideas even when surroundings permit them to filter through.

Just how far this bears upon the fire loss can not at present be stated with any certainty, but there is an evident feeling among many underwriters that these segregated districts are to be avoided even when populated by the people of a country having a low fire record. There is at least some reason to believe that the excessive fire loss as compared with the more literate sections of Europe is to a considerable extent a matter of education, but no one has undertaken to get at the approximate facts as has been done in the matter of accidents. The investigations of the New York Board of Education suggest a very close connection between illiteracy and personal accidents but seemingly no attempt has been made to ascertain to what extent this holds true in fire losses.

We have imported in past years a great many foreign illiterates. There were in the United States, according to the 1920 census, nearly 13,500,000 whites of foreign birth, of whom 1,764,000 were over ten years of age and unable to read or write in any language. This is 13% as against about 2% for the native white population.

All this leads us to question as to just what proportion of the much advertised "American Carelessness" is really "made in America", and whether perhaps a substantial part of it may be imported foreign ignorance.

Returning to the 1922 loss of $521,000,000, it would have been easy in 1920 to have predicted a 1922 loss of at least $511,000,000 with assurance, provided the same rate of loss of property was maintained, basing the increase of values exposed to destruction on the average 7% annual increase of the past decade. But the increase of value accretion has been twice that, being 29½% in two years, and instead of the holdings of the average citizen in 1922 being $3,300, they prove to be $3,600. Assuming the relative value of destructible property at 80% of the total wealth, as in a previous table,* the percentage of loss to property, the "fire tax rate" is $1.61 per $1,000 for 1922 (destructible value $320,000,000,000, loss $521,000,000). In 1921, it was properly $1.68 (it was published as $1.73 on an assumption of a 7% property increase which subsequently proved to be 14%).

* See QUARTERLY January 1923, (Vol. 16, No. 3, p. 230).

If the 1921 "fire tax rate" had been maintained in 1922 the increase of 14¾% in property values would have brought the 1922 total fire loss to $556,000,000, some $35,000,000 greater than it proved to be. This difference may fairly be set down as the approximate effect of the fire prevention campaign. If we had not fought against the fire loss it would probably have been at least thirty-five millions of dollars greater.

If we should slow down to an annual average of 10% increment of property value and still maintain a fire loss of $1.61 per $1,000, the 1933 loss would total $1,344,000,000. Should the population increase at a normal rate, not slowed down by restriction of immigration, we would divide this among 135,000,000 people, a "per capita" of $9.92. Yet the citizen owning $1,000 of property would not contribute one cent more in 1933 than in 1923.

In support of this theory may be cited the steady tendency of the average fire insurance rate to decrease and the marked annual increase of volume of premiums. Insurance rates are based upon average losses and although lagging in any change, serve somewhat as an index of losses. Nobody buys insurance for the mere fun of paying premiums, and the amount of insurance is always an index of the total value of property. Because of certain disturbing features these decreases and increases will not conform to the increase of wealth in the same year and afford merely incidental confirmation.

There appears to be excellent ground for belief that fire prevention effort and education are taking increasing effect and that the proportion of loss (actual "fire tax rate"—not "per capita" losses) will continue to diminish slowly. But just so long as the conditions we term prosperity continue just so long will wealth increase outrun that of population and the "per capita" loss grow by leaps and bounds. We would have to reduce our 1922 loss by about $23,000,000 to bring it down to the $4.53 record of 1921, that is, we could keep the same "per capita" only if we could limit the increase of loss despite property increase to less than $4,000,000, which would surely be a very low rate of loss on an increase of some $40,000,000,000 of property.

Our fire loss, however, is far in excess of that of Northern and Western Europe, disgracefully in excess if one cares to put it that way, but the excess is partly due to conditions that are natural and ineradicable and partly to conditions that have taken three hundred years in forming, and cannot reasonably be reformed in a year or ten years, one factor of which, ignorance and unassimilated immigration, probably plays an important part, how important we do not really know and cannot at this time intelligently estimate.

Fire Protection of S. S. "Leviathan".

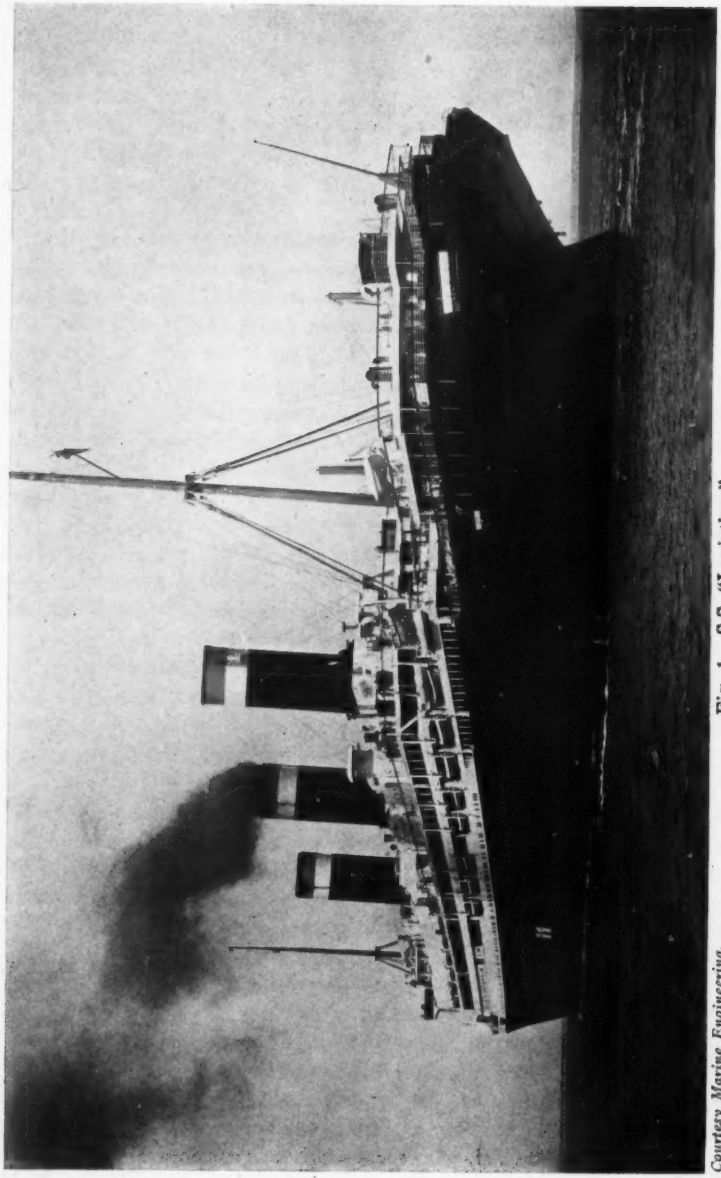
By A. J. Smith,
Secretary, Marine Committee, N. F. P. A.

Devices for the detection and extinguishment of fires, and drills of personnel on American vessels are broadly prescribed by the rules of the United States Steamboat Inspection Service. Compliance with these rules is, of course, compulsory; but on a vessel of the size and characteristics of the "Leviathan," a veritable sea-going city of steel exemplifying the last word in American marine achievement, it has behooved the designers to step beyond a mere compliance with law in all respects and the fire protection system on this great vessel has not been excepted. The multiplicity of decks and structural and other divisions and the number of passengers and crew to be carried added a pointed and practical argument in favor of all extra precautions against fire.

The dimensions of the "Leviathan" are 907 ft. long x 100 ft. beam x 58 ft. depth; and from bridge to tank top there are twelve decks running continuously or partially through the hull or superstructure. Beginning at the bridge deck, these are designated A, B, C, etc. (with the exception of I) to L, a flat on a level with the deep tank tops more than 25 ft. below the water line. The hull proper up to the structural deck (F) is also divided by watertight transverse bulkheads into 17 main compartments, which in turn are subdivided by partitions to suit the intricate requirements of a passenger vessel. Some of the main subdivision bulkheads are of steel, either unsheathed or sheathed with fire-resistive joiner work, and the remainder are of wood frame finished with similar panel board, molding and trim. Except for some of the original carved decorative wood work in the saloons, lounges, etc., which has been left in place or restored, fire-resistive construction has been used, especially in the living spaces.

A system of guide charts posted at conspicuous points on each deck, usually in a passageway, gives very clearly the direction of egress and indicates by a red mark the exact point at which the chart is located. While possibly not designated as a fire protection measure, these charts certainly serve the purpose for those who take the trouble to locate their quarters in relation to exits and passageways.

The watch personnel, whose duty it is to report any irregularity on board, consists of a corps of eight men on duty from 8 P. M. to 6 A. M.,



Courtesy Marine Engineering.

Fig. 1. S.S. "Leviathan".

Courtesy Marine Engineering.

Fig. 2. The Fire Control Station.

in eight designated sections of the vessel. This watch is known as the "master-at-arms patrol" and records the rounds of its personnel by means of a recording clock system, cards of which are filed each day with the chief officer of the deck department. In addition, there are three watches of two men each, acting as deck police and designated as "ship's masters-at-arms," whose duty among others is control of passengers and direction of stewards in case of local emergency, such as a stateroom fire. There is also a "steward's watch" on each passenger deck.

The central reporting station for all alarm systems is located on the bridge deck abaft the chart room, and is known as the fire control station. Three watches of fire guards, one man each, are carried and one guard is always on duty at the station to immediately report an alarm from any portion of the vessel to the bridge watch officer who takes such action as may be deemed necessary.

There are three systems of fire detection and alarm installed, all recording in the control station. The manually operated electric alarm is of the ordinary type installed in buildings, by which the breaking of a glass disc releases a spring loaded contactor which in turn closes a circuit in the intercommunication service and actuates an audible and visible alarm in the control station. There are 45 such manual alarm boxes distributed throughout all parts of the vessel except the machinery and cargo spaces.

The entire passenger and crew space, including saloons, passageways and staterooms, are served by the Aero Alarm System as shown diagramatically in Fig. 3, which is a replica of the diagram in the fire control station. There are 26 cabinets distributed as shown, representing 218 tube circuits, and the small .08 in. diameter air tubes are either concealed or so cleverly worked along the moldings throughout the spaces served that unless one is looking for them they are hardly noticeable. There is 25 miles of this tubing used, with an exposed surface of 75%

Fig. 1. S.S. "Leviathan".

Courtesy Marine Engineering.

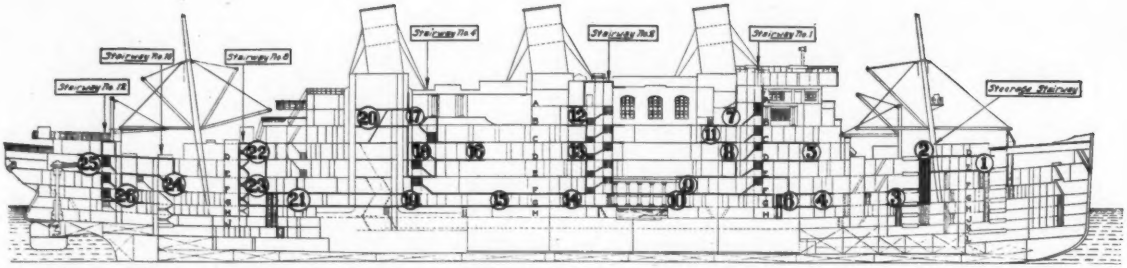


Fig. 3. Diagram showing the location of stations of the Aero Automatic Fire Alarm System in passenger and crew spaces.

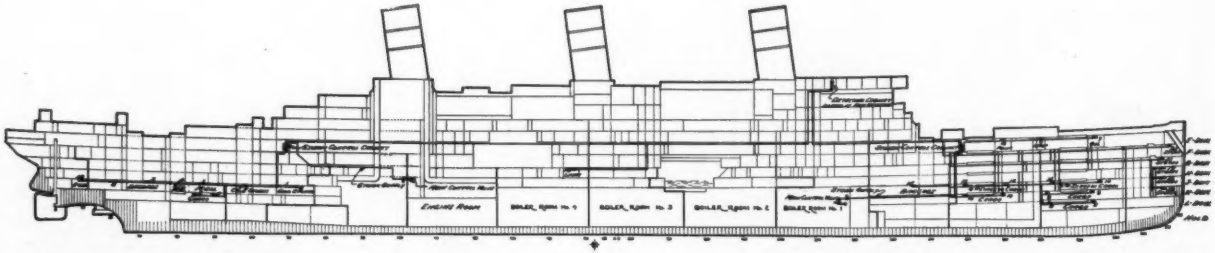


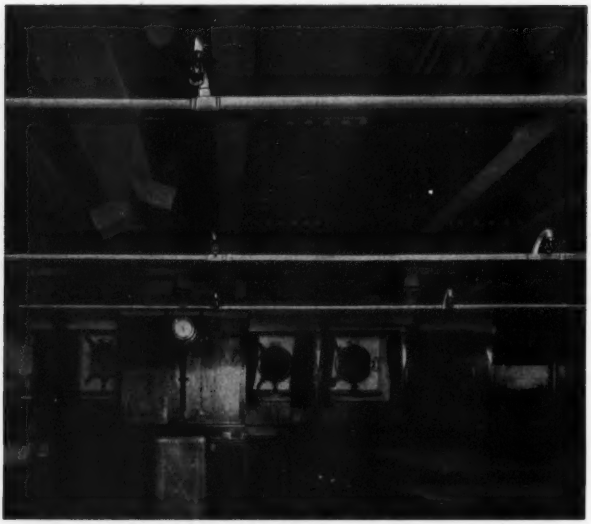
Fig. 4. Diagram showing the arrangement of the Rich System of smoke detection installed in compartments used for baggage freight and stores.

of the total length. The tubing in staterooms is worked into coiled rosettes that detract nothing from the scheme of decoration. The electric alarm actuated by the thermal expansion of air in the tubes is served by the vessel's intercommunication circuits. There is an electric loop circuit to each cabinet controlling a trouble circuit in the fire control room which is served by batteries, the only ones in the system, and this registers any electrical defect by a buzzer. On such a derangement signal sounding, the fire guard on watch reports to the ship's electrician to effect repairs. It is said that no such trouble has yet developed.

This system serves by far the greater portion of the vessel as a relatively large part of the cubic capacity of the hull is taken up by passenger and crew accommodations. The machinery space, being constantly under the watch of the engineering staff, is not served by an alarm system recording on deck.

The compartments used for baggage, freight and stores, as shown on Fig. 4, are served by the Rich System of smoke detection, utilizing special tubing or the steam smothering pipes prescribed by law for such compartments as ducts through which to draw small jets of air to the outlets in the fire control room cabinet. There are 22 of these outlets from as many compartments, all of the latest pattern, with illuminating devices to increase visibility of smoke if drawn through, and motor driven exhauster sets in duplicate. With the exception of fore and after peak stores and linen locker, which are accessible to personnel during the voyage, all compartments served by the Rich System are equipped with steam smothering lines. The steam smothering valve manifolds, with special locked valves designed to prevent back-flow of steam to cabinet when open, are situated on E deck, forward and aft, under control of the watch engineer; so that on information from the bridge, reported through the fire guard, smothering steam may be turned into the burning compartments without disturbing other parts of the system.

The other system required by law is of course the water service to fire lines. There are 120 fifty-foot lengths of 2½-in. hose distributed to meet the rule requiring a " . . . sufficient number of outlets arranged so that any part of the steamer can be reached with water . . . from a single 50-ft. length of hose from at least one of these outlets." The hose is kept connected, and a pressure of 45 lbs. is maintained at the highest outlets, thus requiring 80 lbs. at the fire pump in the hold which is in constant service to maintain this pressure. In the saloons the hose cabinets are built into the bulkheads, handsomely finished and far from a detriment to the decorative scheme. In addition to the hose, about 200 soda-acid 2½ gallon extinguishers are mounted in racks or stands at convenient locations in the accessible portions of the vessel, and carbon



Courtesy Ira G. Hoagland (Member N. F. P. A.).

Fig. 5. Third Class Cabin where the original automatic sprinkler equipment has been retained.

tetrachloride extinguishers are placed where fires in electrical apparatus might occur.

Most of the fire protection equipment is new or has been altered to meet American law and practice, but the original sprinkler system covering crew's quarters and third class cabin aft on G deck and below is practically undisturbed. (Fig. 5.) This system is automatic to the extent that a head of about 70 lbs. is maintained from vessel's fire mains through a 1-in. line, connected into the 4-in. service line, which would serve to furnish an initial water supply in case of a sprinkler head opening but would not flood the section involved until the 4-in. service main was turned on at one of the three manual control stations on G and H decks. The sprinkler system is not used in the baggage or cargo compartments, steam smothering being considered sufficient and less damaging to contents in case of operation, accidental or otherwise.

The machinery space is served in the engine room by regular hose equipment, and soda-acid 2½ gallon hand extinguishers. The dynamo room is additionally equipped with carbon-tetrachloride hand extinguishers for use in case of electrical fires. The four fire rooms containing forty-six, five fire oil burning boilers are protected by an elaborate Foamite system. The Foamite plan is located on H deck, over No. 3 Boiler Room, and consists of duplicate pumping sets and two 3500 gallon cylindrical tanks, one

for each ingredient of the mixture. One pair of pumps is driven by a steam turbine and the other by an electric motor.

There is a 4-in. delivery main for each solution from which are taken the branches to the fuel oil filling stations on F and G decks and to the fire rooms, both for distributors on the tank tops and for 1-in. hand hose. There are 68 distributors and 4 hand hose stations in each fire room. These branches are controlled by levers near the stations and in the lower fire rooms which, with one movement, mechanically actuate the spring or ram operated stop valves and pump starting devices. Both sets of pumps are started simultaneously by this operation, but either is sufficient to serve any battery of distributors so that one may be stopped by hand when the pressure of 60 lbs. at the pump is attained. The pulling of a distributor lever operates the entire battery in the fire room which it serves, while hose levers operate only the four hose lines. The distributor controls are so cross-connected that any fire room battery may be operated from either adjacent fire room as well as the one in which fire occurs, or from G deck. In order to detect accidental operation of any part of the system, a visible and audible signal in No. 3 fire room registers the operation of any control. Two and a half gallon Foamite hand extinguishers are also distributed throughout the fire rooms.

The occasion for practical demonstration of these detection, alarm, and extinguishing systems has not yet arisen, but random tests are made daily by masters-at-arms and results recorded in the fire guards' log. The bugbear of an alarm system out of order is eliminated so far as human attention and care, in addition to mechanical trouble warnings, can establish that condition.

The necessity of protection as indicated in the introduction has been met adequately by thorough consideration of every hazard; and both installation and organization meets the highest standard of fire protection practice.

Safeguarding Domestic Oil Burners.

By Curtis R. Welborn.*
(Member N. F. P. A.)

Oil has and will, in all probability, play for a considerable period of time a prominent part in national and international relations, but not until recently have we given much concern regarding the part it is beginning to play in our domestic affairs. The prevailing coal shortages and accompanying high prices have forced the great buying public to seek available and cheaper fuel. As a result of the demand on the part of the public, the combustion, mechanical and electrical engineers, as well as the "jack-of-all-trades" of the country, have made and attempted to make oil burning devices for domestic use. Some of these devices are well manufactured of suitable material, and safeguarded as far as the advancement of the art dictates, while a number are nothing more or less than piles of hardware, and are a real menace to life and property. Those devices that in principle possess real merit and that are equipped with up-to-date safeguards still may be hazardous. Unless the device is properly constructed, installed and maintained, oil burners may not be considered as having been safeguarded so far as practicable. This article from a fire prevention viewpoint may be termed a brief survey on "How To and Not To Do It" with respect to the construction, installation and maintenance of domestic oil burning equipments. Briefly, it is thought the factors that will govern the success of any domestic oil burner are:

First: The device must be correct in principle and constructed properly.
Second: The device must be sold correctly.
Third: The device must be installed and maintained correctly.

Experience over an extended period of time involving research and the testing of domestic oil burners leads to the grouping of such burners in two distinct classes: those constructed by the cut and try method, in which little or no consideration has been given to varying conditions under which the device will be called upon to perform in actual service, the character and combustion of the fuel utilized in the device, the known physical properties of the metals employed in the assembly, the safeguarding of the equipment against the tampering of the laymen, as well

* Associate Engineer, Gases and Oils, Underwriters' Laboratories.

as to internal phenomena that lead to or introduce additional hazards; and the second type, designed prior to the construction of a test sample, in which careful attention has been paid to all features previously mentioned.

When subject to actual service conditions, covering an extended period of time, the burner of the first type has been observed, in most cases, to fail in operation, and in the failure the construction, in some cases, introduced hazards jeopardizing property to a great extent. It is deemed advisable, from a fire protection viewpoint, that domestic oil burners be designed in proper sizes or with some form of adjustment to meet the varying field conditions with respect to the many different types of the existing heating units and their inherent characteristics, and that combustion of the fuel specified by the manufacturer of the device be proven suitable with oils of both the asphaltum and paraffin bases. It is also necessary to determine that the materials employed in the assembly, with particular reference to those exposed to high temperatures, possess properties that will insure durability and reliability of operation for an extended period of time, and that the device be safeguarded with apparatus that will render the equipment inoperative in event of flooding or other trouble in the heating equipment that may introduce fire and casualty hazards.

The Manufacturer's Sales Policy.

As the sale of oil burning equipments is largely a question of the policy of the manufacturer, it may appear to be far fetched to the average individual, for those interested in the reduction of fire hazards to state that this is a factor also concerning them; nevertheless, this is a fact. As an illustration, overzealous salesmen often, through a firm belief in their product and the lack of technical enlightenment, misrepresent to the innocent buying public, the character of the fuel that their equipment will consume, its economy as compared to coal and low operating costs, and fail, in many cases, to make a careful survey of the installation in which the burner is to be installed. The purchaser finds that he can buy the fuel of the specific gravity recommended by the salesman, but when placed in service, the device is soon inoperative or fails to function. Under the varying conditions imposed, the equipment fails to substantiate the salesman's statements about low cost of operation and economy of fuel as compared to coal, and that the burner capacity is adequate for the heating plant. The purchaser then assumes that the equipment is out of order, as the sales talk assured proper performance on all of these points, and proceeds to make adjustments to accomplish the end. As a result of the tampering on the part of the average layman, fire and casualty hazards often ensue. It is thought and suggested that the manufacturer's policy with regard to sales propaganda and talk should be confined strictly to

facts, particularly those of a technical nature, and that all salesmen be carefully and thoroughly schooled before attempting to secure contracts.

The installation of an oil burning system may be divided into three distinct phases; namely, the tanks, the pipe lines, and the burner proper. In many instances there is an additional phase, the electrical. Each of these phases offers certain outstanding problems, which, if neglected, are liable to introduce hazardous conditions that should be avoided.

In considering the question of tanks, three types of installations are commonly employed. The first and most common is the use of the "auxiliary supply tank" as the main storage. The second is the use of an auxiliary supply tank filled from an underground storage tank. The third is use of a force pump, drawing fuel oil from a storage tank located below or above the point of consumption.

Before discussing in detail the more desirable methods of installation, it is thought advisable to present here a compilation of misinformation that has been doled out to the public by individuals who apparently have given the question of safety a very minor position in presenting their devices to the ultimate consumer. To bring out these items clearly, the reader's attention is invited to Fig. 1 which may be titled "How Not to Install an Oil Burner."

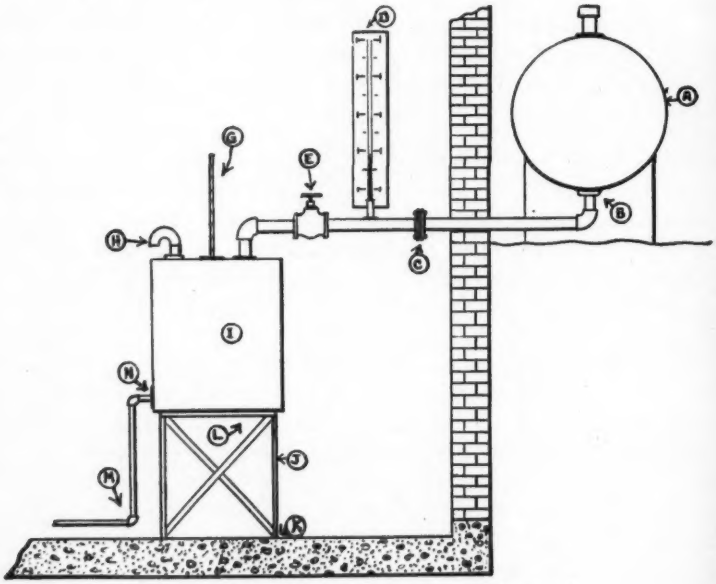


Fig. 1. "How Not to Install an Oil Burner."

A. Storage tank above ground.

B. The pipe line between the storage and auxiliary tanks leading from the bottom of the large container.

In event of a pipe line rupture or leak, the contents of the storage tank will be discharged into the basement.

C. The use of flange unions with rubber gaskets.

Rubber will in time be rendered useless as a gasket when in contact with the liquid fuel.

D. A glass gauge located in the basement, employed in the line to indicate the oil level of the storage tank.

Breakage of glass gauge will discharge the contents of the storage tank into the furnace room.

E. A shut-off valve without standard packing box.

Valve subject to leaks due to leaking stuffing box and if left open even slightly will discharge oil into the basement.

F. The impossibility of having an overflow pipe from the auxiliary tank to the storage tank.

No means provided for discharging excess oil to main storage.

G. Ordinary cork float gauge, with stem projecting through top of tank.

In event of filling tank to capacity liquid fuel will be discharged into the room.

H. Auxiliary tank vented inside of basement.

In event of a basement fire oil vapors will increase the hazard.

I. Tank constructed of very thin material unprotected against corosion.

Liable to leak.

J. Tank resting on combustible supports.

In event of fire, supports will be consumed and fuel added to the flames.

K. Supports not fixed to floor.

External shocks applied to the tank will strain connections and cause leakage of liquid fuel.

L. No means for cleaning auxiliary tank.

Necessitates dismantling lines, and in all probability re-assembly will not be accomplished in a manner that will insure tightness of joints.

M. Pipe line to burner exposed.

Application of external shocks to small pipe line will likely result in severe strains on connections causing leakage.

N. Pipe connections to the tank secured by soldered flanges.

Flanges which are not riveted as well as soldered are almost certain to fail and permit discharge of oil through the fuel opening into the tank.

NOTE: All of the above items are not shown in detail by Fig. 1, but the list may be considered as an example of what actually has been found in service.

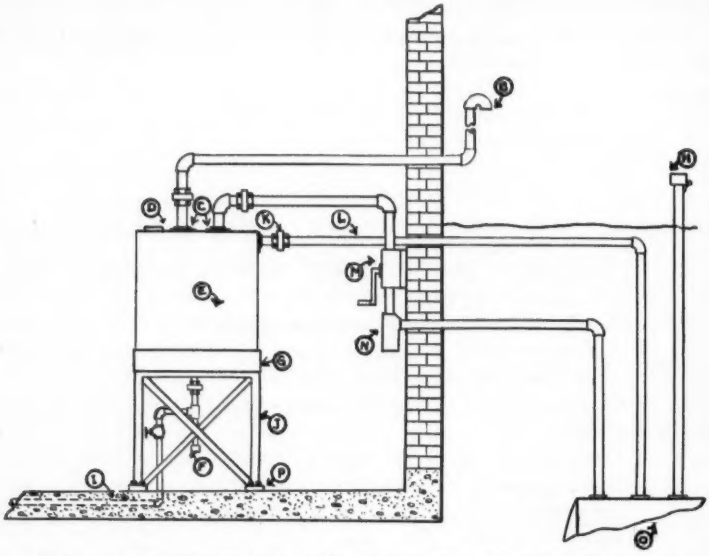


Fig. 2. An approved installation with outside underground storage tank.

In studying the existing requirements covering the installation of tanks for domestic oil burning equipments, there are two installation forms that may be followed with a reasonable degree of safety assured. These are shown in Figs. 2 and 3. In Fig. 2, the labeled storage tank (O) is buried beneath the lowest level of the basement floor line and filled and vented by means of a standard fill and vent fitting (H). The oil is drawn from the underground storage tank by means of a standard hand pump (M), through a standard strainer (N), and discharged into an auxiliary tank (E), constructed of a metal not less than No. 18 U. S. gauge and with capacity not exceeding sixty gallons. The unions (K) used in this assembly are of the brass to iron conically seated type. The tank is equipped with an overflow line (L) at least one pipe size larger than the discharge line leading from the pump, and also with a weatherproof, hooded vent (B) terminating outside of the building.

The auxiliary tank is also provided with an indicating gauge (D) of a type in which the breakage of the glass will not discharge oil into the building. The tank is mounted on a support (G) and (J), of a non-combustible material that is rigidly fixed to the floor (P). All connections to the tank are assembled by rivets and solder or by the welding process. The piping between the auxiliary tank and the burner (I) is

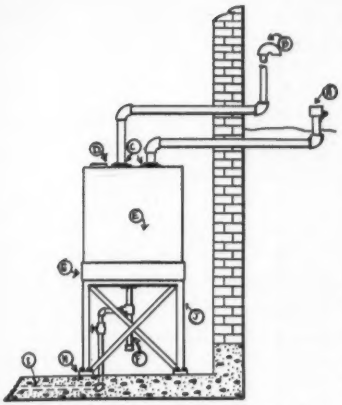


Fig. 3. An approved installation using auxiliary supply tank as main storage.

either buried in a concrete trench or snugly run in corners of the basement to afford the maximum protection. The tank is provided with a means (F) for cleaning out the usual foreign matter held in suspension in liquid fuel which may pass strainer (N).

In Fig. 3, in which the inside tank contains the entire storage, the same practice with respect to the tank is followed as shown for the auxiliary tank in Fig. 2, with the exception that the tank is filled from the outside of the building.

The roofs of subways, the presence of tide water and others of nature's natural obstructions have forced the users of oil burning devices in some instances to store liquid fuel above the point of consumption, and should a pipe line rupture occur in installations where pumps are employed to draw the fuel from the tank, a syphon may be created and discharge the contents of the storage tank into the furnace room. In Fig. 4 a diagrammatic sketch is given showing a pump at (A) drawing the liquid fuel from storage tank (B) through an anti-syphoning device at (C). This anti-syphoning arrangement may be secured by different methods, but the end to be secured is to have all pipe connections into the tank located above the liquid level and the discharge of oil in case of pipe breakage effectually prevented.

It has been observed in some instances where devices that are safeguarded as far as the state of the art dictates, and installed in accordance with the regulations, that operating troubles are often experienced by the purchaser. Upon investigation of the causes leading to this trouble the service man finds that little or no attention has been given the device. *Mechanical appliances must be examined frequently* to insure proper performance. Manufacturers are furnishing maintenance instructions and if proper functioning of the device is to be reasonably expected these must be followed. It is considered good practice by those actively engaged in this work to thoroughly examine these equipments once each day.

In conclusion, it has been noted that many localities have not made use of the available information on this subject found in the Regulations on Oil Burning Equipments published by the National Board of Fire

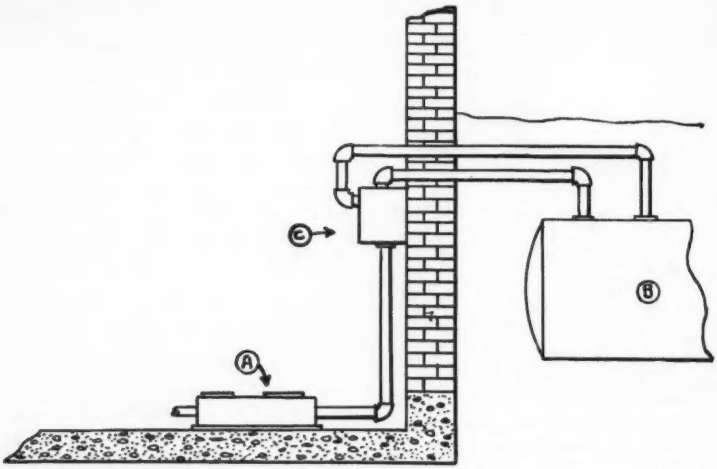


Fig. 4. Anti-siphoning arrangement where storage tank is necessarily located at the point of consumption.

Underwriters, as recommended by the National Fire Protection Association, which will, upon request, be supplied free of charge. As a result, a very wide difference of practice is manifested in the types of burners and installations permitted. Only those types of equipments the merits of which have been tested and proven and that are installed in accordance with practices accepted by the authorities should be allowed, if we who are attempting to safeguard America give the public what it is asking of us.

Promoting Water Works for Fire Protection.

By Ralph R. Silver, American Cast Iron Pipe Co.
(Member N. F. P. A.)

Water is recognized as the natural antidote for fire. Many things, of course, are responsible for the enormous annual fire loss, but inadequate water for fire fighting is perhaps as much to blame as any other one thing. The importance of fire prevention is realized; too much emphasis can not be placed on the fact that an ounce of prevention is worth a pound of cure. Let us push forward in our efforts to prevent fire, but in the meantime let us not fail to thoroughly equip ourselves to fight the fires we do not prevent. Here appears an interesting anomaly, —the tendency of fire underwriters, fire departments, building code experts and municipal authorities to concentrate on certain causes of fires to the neglect of fire fighting.

Prior to the Baltimore fire in 1904, little attention was given to the importance of water supplies for fire protection, and even now the importance of the water works is so little appreciated by the fire chief that special efforts must be made to educate him on this subject. A good example of this is the organization of fire chiefs and water works men recently formed in the State of Indiana, the object of which, in the words of Fire Chief J. J. O'Brien of Indianapolis, is "co-operation between the fire department and the water works, which I am sorry to say in a great many cities and in a great many states is not as close as it ought to be. One of the things I think every fire chief should do is to get in touch with his water works."

The most important factor in fire protection is a water works. The National Board of Fire Underwriters rates a water works as of more importance in fire protection than a fire department, for the simple reason that a water supply may be of some use without a fire department, but a fire department without a water supply is practically helpless in case of a fire. In the Grading Schedule of the National Board of Fire Underwriters, the water supply is given a weight of about one-third of the total requirements, as shown by the following table:

	Points
Water supply	1,700
Fire department	1,500
Fire alarm	550
Police	50
Building laws	200
Hazards	300
Structural conditions	700
Total	5,000

An interesting recent example of the need for water works systems is furnished by the fire at Martinsville, N. J., on March 28, 1923. The fire started in a garage and is believed to have been caused by a helper dropping a lighted cigarette into a can of varnish. A strong north wind spread the fire with great rapidity and soon a number of buildings were blazing. There was no fire apparatus in Martinsville and calls were sent to nearby communities for aid. All of these responded, but on their arrival there was found to be no water except in a stone quarry more than 1,000 feet from the section on fire. It was discovered that the combined hose of the fire companies would not reach this quarry and nothing could be done except to form bucket brigades which were woefully inadequate.

The fire burned for three hours and more than fifty persons were left homeless. Fifteen houses, twenty barns and a garage were consumed with a loss estimated at $125,000.

It is assumed that the readers of this article are well aware of the value and need of a water works in any community. The purpose here is to offer suggestions that may be helpful to readers in promoting water works among those citizens who are not so enlightened. Therefore, when frequent mention is made in this article of the value of a water system, it should be remembered that the arguments are cited to be passed on to the man who needs them. In this respect only can this article hope to be of any real service.

"Sales Campaigns" for the Taxpayer.

It is an unfortunate fact that plans for public improvements frequently fail to materialize simply on account of public ignorance. Many cases can be cited where the great need of a water works was recognized by city officials and leading citizens and yet a proposed bond issue to pay for the improvements met with utter defeat at the polls. The remedy is public education. City officials, or whoever may be interested in the construction of water works, literally must organize a "sales campaign" to "sell" the idea to the tax-payers. To do this successfully, it is necessary that all the facts affecting the particular situation involved be compiled, analyzed and digested and put in such form that their import can be grasped by the average citizen.

The first step is the employment of a competent consulting civil engineer. Experience has shown how unwise it is for a small community to attempt a public improvement, such as a water works, without the impartial and unprejudiced guidance of a consulting engineer. There are many engineers who make a profession of this kind of work, and no difficulty should be experienced in getting in touch with one of them. Without expert engineering advice, costly mistakes can be made in design

and selection of construction materials. Many of the cities which now have inadequate fire protection, have water systems, but not of the right kind. They may be of poor design or of unsuitable materials, even though the cost may have been as much as that of an adequate water system. The following paragraph is taken from the report of the N. F. P. A. on the great Salem, Massachusetts fire in 1914:

> Fear of the known weakness of the water mains paralyzed all efforts to use water except by the steamers supplying their own pressure. The abundant supplies of Peabody, Danvers and Beverly were gingerly tied into the Salem system in fear that the pressure they had to contribute would shatter Salem's obsolete old mains and end the water-throwing for good. With water enough to raft Salem out to sea, her citizens on the border of the fire zone threw away their garden hose, and extinguished the sparks on their shingle roofs with tree-spraying outfits!

In 1921, almost a city block, comprising approximately half the business section of Russellville, Alabama (5,000 population), was destroyed. The account of the fire contains the following paragraph:

> The water works plant of the city is out of commission and fire fighters resorted to primitive methods, but the blaze practically burned itself out after destroying more than two-thirds of a business block in the heart of town.

In 1912, nine years before the fire, Russellville spent $16,000 on water pipe. Thinking to economize, the town did not employ a consulting engineer, with the consequence that in Russellville's hour of need, its water works failed. Although equipped with a good water supply, reservoir, standpipe, hydrants and hose, the chain of protection was no stronger than its weakest link—the pipe line. Soon after the fire, W. J. Porter, Mayor of Russellville, made the following statement:

> We have been paying the same rate of fire insurance as a town without any water works whatever. During the fire we were unable to secure a gallon of water from our mains. We have learned our lesson, and our new mains will be cast iron.

The Engineer's Report.

A note of warning might be sounded here to make sure that an engineer is employed who understands the principles of promotion. Cases are known where the preliminary reports of an engineer have been so technical and theoretical that neither the city officials nor the public were ever able to understand them. What is desired is not a long-winded technical report, but a digest of the salient facts which will appeal to the public. A water works is a very human affair and should be so treated.

This information once accumulated, the campaign really gets under way. Some of the agencies commonly used include: newspapers, public meetings, civic organizations, women's clubs, churches, business organizations, mail.

It will be found that the local newspaper will be a willing and powerful factor in a campaign. The editor is a booster and will be glad to publish all kinds of articles submitted to him about the new water works. This is one of the first steps in arousing public interest. The next may be a mass meeting, addressed by local business men who are familiar with the situation. Coincident with this development, the civic organizations, women's clubs, churches and business organizations should be interested and all will be glad to take an active part. At any time during the campaign, use may be made of the mails to carry messages direct to the homes of the voters. Experience has shown, however, that this "direct advertising" as it is called, can be best used as a "clincher" for the campaign. An attractive but inexpensive leaflet can be printed as the campaign draws to a close and the date for the bond election approaches. This should be mailed direct to the home of the voter, where the interest already aroused will insure that he will study it. Literature for this purpose, in the shape of a questionnaire, with stated questions and answers, can be used with tremendous effect.

It is probable that the consulting engineer will need few suggestions as to the kind of data which will appeal most to the voters. However, one of the best sources of local data that can be used is pictures. Pictures constitute a universal language. They are much easier understood and have a greater appeal than text matter. Photographs of water works in neighboring towns compared with photographs taken in your own town, showing local fire-traps, dangerous wells, and similar views, can be used with good effect in the newspaper and on slides furnished to the local motion picture house. Health statistics may also be gathered and compared between towns which have and those which have not a public water supply. A similar comparison of fire insurance rates appeals strongly to every one. Maps can be made of the proposed water lines and shown in the newspapers and motion picture shows.

Advantages to the Community.

Even though the primary purpose in the promotion of a particular water works may be fire protection, the point should not be overlooked that the construction of a water system is a subject of much wider appeal For example, the average community is keenly alive to its development in population, industry and wealth, and realizes that in addition to protection from fire, water is needed to safeguard health, for the economical operation of industry, and for a convenient domestic use. In all discussions of the matter, therefore, either through public speeches or through printed matter in the newspapers or special booklets, the importance of water in all phases of human endeavor should be clearly brought out.

An interesting point is the fact that the average citizen in a small town has little conception of the financing of such a proposition. If the suggestion is made, for example, that the installation of a complete water works will cost $60,000, the average taxpayer of such a community will show concern over what he considers this large sum of money. If it is explained, however, that the same water works system can be installed and operated for approximately $9,000 per year, which in a town of 1,500 population would average about $6.00 per year per person, the matter is viewed in a different light. It thus becomes fairly easy for each citizen to compare the service he will receive with the annual expense and thus realize what he is receiving for his money. Detailed explanations should be made in the simplest language possible as to what is meant by annual interest and sinking funds. The fact that insurance rates are reduced by the installation of a water works, frequently effecting a saving to the citizens nearly equal to the actual expense of the water works, is an impressive argument. The fact should never be lost sight of that a water works is really an asset rather than a liability and that if properly constructed and financed it should be self-sustaining. It is one of the few public improvements which can be had without any great expense to the citizens and this point can be proved if the situation is well handled and the design and construction are sound from an engineering standpoint. Citizens will vote bond issues when they realize this.

Financing.

It would be too large an undertaking to attempt to explain in this article any detailed plans or methods of securing the necessary funds and authority to build a water works. The various states have somewhat different laws covering the issuance of bonds for purposes of this kind. The usual procedure is for a small group of interested citizens or city officials to sign a petition to come before the proper city authority asking that there be submitted to the voters the authorization of a bond issue for the construction of a water works. If this petition is favorably acted on a consulting engineer is engaged to make a preliminary survey and submit an estimate of the cost of the construction proposed. This determines the size of the bond issue to be voted on.

The bonded indebtedness of municipalities has various limitations in the different states and there always are certain regulations connected with a bond issue which must be strictly followed in order to make the bonds legal. Some states have a state special assessment act under which the cost of a water system can be met by special assessments against the property holders, the assessment being paid for in installments during ten years. In this way the great bulk of the cost of a water system is taken care of without impairing the borrowing capacity of the municipal-

ity. As a matter of fact, it is very difficult in a small town to build a complete water works system by means of a straight bond issue on account of the constitutional limitations of the bonded indebtedness, unless the water system is composed entirely of 4 in. mains or even smaller, and even then it is frequently impossible to authorize a large enough bond issue to finance the project.

A warning might well be issued here against the false economy of small-sized water mains. It is no longer considered good engineering practice to install pipe as small as four inches, in most cases. In the past, especially in the smaller communities, many water systems have been built with four inch pipe as the predominating size for distribution lines. But experience has proven that most communities soon outgrow the limitations of these small pipe and a tremendously serious fire hazard thereby develops.

One of the largest railroad systems in the country has recently adopted a policy prohibiting further use of four inch mains because experience has shown the limitation of capacity to carry water in lines this small soon required the installation of larger pipe. Railway water mains might be considered semi-permanent as compared with municipal water systems. With pipe that lasts 150 to 250 years in service, the false economy of taking up and relaying a four inch water main because it is too small for the increased demands on it is very apparent. And if this is not done, a fire hazard exists that no community can afford to ignore. The remedy is to look further ahead and use six and eight inch mains where in the past four inch pipe has been used.

In connection with the financing of water works, there is opportunity for valuable work in securing the passage by state legislatures of special assessment acts similar to the one now in use by the state of Illinois Under such a law, the water mains, which represent usually 75% of the cost of a water system, can be put in by special assessment and a small general bond issue of the municipality can be used to take care of the pumping station, machinery and storage reservoir. Illinois is a state well taken care of in this respect, while in the neighboring state of Indiana no special assessment can be made.

Municipal water works bonds usually are in active demand and little trouble is experienced in selling them. It is good practice to leave the rate of interest open, if possible, or at least to specify it by stating the maximum, for example, not to exceed 6%. This gives the city authorities an opportunity to issue the bonds at a lower rate than 6% should it be possible to sell them at par at a lower rate, which is often the case. In some states proceeds from the sale of the bonds must be in the city treasury before a contract can be let for material or labor to construct the water system. In other states this is not necessary. In some states

work and material can be paid for in bonds and in others the payment must be made in cash.

Some times a water system is installed by the municipality giving a franchise to a company, corporation or individual authorizing the installation and maintenance of a water system over a certain specified period of time. Such a franchise can be drawn so that the town may acquire the water plant at an agreed price at the end of a certain period of years. In some localities there has recently been a plan used by which a water works company is organized as a private corporation, the municipality taking 51%, or a controlling interest of the corporation stock. The balance of the stock is sold to the citizens of the community. Thus it is claimed the water works system is kept out of politics to a large degree and having stockholders in addition to the stock owned by the municipality, the company becomes subject to the control of state public utility commissions in regard to rates, sinking funds, depreciation, etc. Fixed charges are determined for fire hydrants and for water for public use, which the city pays to the water works company out of its general fund and thus the water system operates as a separate corporation entirely dependent upon itself for support. This eliminates the too common practice of insufficient rates to operate the water system on a self-sustaining basis, with the accumulation of a deficit to be made up at the end of each year out of the general fund of the city.

If the entire population of the United States lived in municipalities, the annual fire loss of the United States last year would have paid the interest on enough money to construct a water system to furnish water to every one of them and leave enough for an annual sinking fund sufficient to retire the total indebtedness in thirty-five years.

Construction of water systems, and especially pipe lines, during the world war was practically abandoned. For two years following the war, construction was still held in check by the high price of materials. The enormous requirements that have thus been allowed to accumulate during a period of several years have never been caught up with. Unprecedented activity has been shown in construction of water works during the past two years, but the rapid growth of urban population on the one hand and on the other the state of inadequacy to which water systems were allowed to sink, has brought about a condition in which many more years may be required to place the water systems of the country in condition for efficient fire protection.

The alarming fact is that in many cities, large and small, young and old, the population has grown faster than the water supply. Engineers know the perilous condition of millions of dollars' worth of property in the United States and Canada on this account. But before real and

lasting progress can be made in providing water for fire protection, the public in general must realize the situation.

These are the things to be passed on to the public in promoting a water works for fire protection and through it all keep hammering home the one significant fact that appears in the record of nearly every conflagration—inadequate water. The outstanding feature of the Baltimore fire in 1904 was lack of water. The Salem fire of 1914 was characterized by lack of water. In 1921, the little industrial towns of Grove City, Ohio, and Russellville, Alabama, suffered enormous fire losses through their lack of water. All men need is to know these things. Promoting water works is a matter of education.

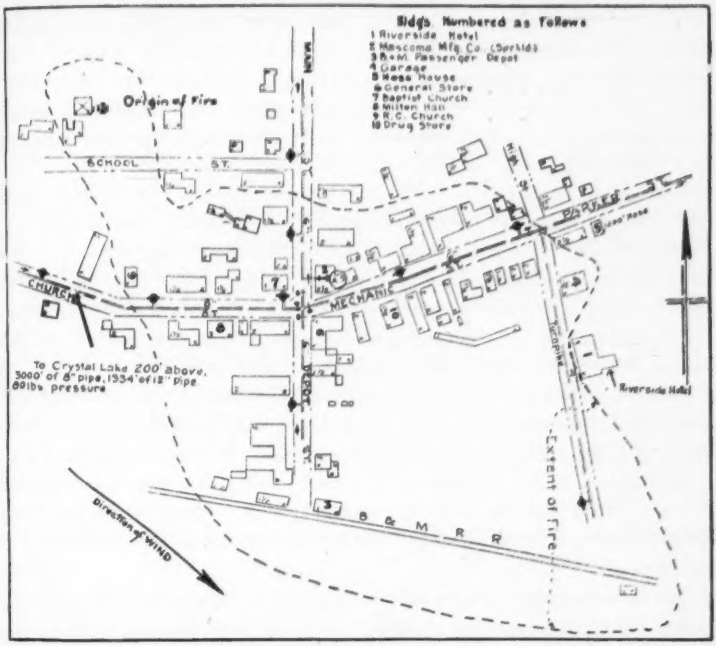
The Canaan Conflagration.

By Gorham Dana.
(Member N. F. P. A.)

On June 1, 1923, Canaan, N. H., was an attractive village of some 1400 inhabitants nestled in the Mascoma Valley about half way between White River Junction and Franklin. There was one main street, lined with stately trees, and a few cross streets. The buildings, consisting of dwellings, a few stores, halls and churches, a hotel and one manufacturing plant, were practically all of frame construction with shingle roofs. While in the center of town the buildings were somewhat congested, it was not a village where a conflagration seemed probable. If an insurance engineer had told the inhabitants that a conflagration was probable and that the best method of preventing it would be to replace the wooden shingle roofs with non-flammable roofing, they would probably have thought that his imagination was better than his judgment.

On the afternoon of June 2, the once beautiful main street was a mass of smouldering ruins. The fire had started at 11.10 A. M. in a barn in the western part of town. Children were playing with matches and the hay was soon a mass of flames. A strong westerly wind fanned the flame and sparks were soon flying in showers toward the heart of the village. A barn at the further end of town caught from a burning ember blown in an open door and soon shingle roofs in various locations took fire. The fire alarm, consisting of a church bell, was rung and brought out the call fire department. An effort was made to get a stream on to the first barn but as the nearest hydrant was 500 feet away this took time and the barn was soon a roaring mass of flame.

The water works system was fairly good being supplied by a lake of ample capacity about a mile distant. The water was piped in by a



The Canaan, N. H., Conflagration (approximate scale: 1 in. = 400 ft.).

12 in. main reducing to 8 in. under a pressure of about 80 lbs. There was a fair supply of hydrants covering the central part of town.

Help was called from White River Junction, Lebanon and even Concord, 50 miles distant, and aid arrived from the two former towns in time to be of service. The steamer from Concord, however, was not in time to be of assistance. The task was too much for the fighters and the fire swept completely through the center of the town and burned itself out. Some 47 buildings were destroyed, including 2 churches, 5 stores, several halls and garages, the railroad station and the sprinklered overall factory of the Mascoma Mfg. Co.

This sprinklered factory was a 2½-story frame building used on the first floor as a general store and above for the manufacture of cotton overalls. The sprinklers were on a dry system fed by a 6 in. connection from a 6 in. street main. Open sprinklers had been placed under the eaves on the easterly side to protect against a bad exposure in that direction, but they were of no value in holding a fire coming from the west.

Sprinklers opened inside the building but failed to hold the fire because the building was frame and because the water supply was crippled

early in the fire when many hose lines were abandoned by the fire fighters. The sprinklers in the lower floor and basement were of considerable value and there was a little salvage in the basement. The value of this plant was about $70,000 and the insurance was $52,000 on which a total loss was paid. This was the only building in the burned area not totally destroyed.

Two fatalities occurred. Horatio Gilman and his son Stanley were fatally burned in trying to remove valuables from their general store.

One of the most interesting features of the conflagration was the saving of the Riverside Hotel. This was a large frame building at the extreme easterly end of the town not heavily exposed but in the direct path of the shower of sparks. Buildings on both sides and across the street to the west were burned but this building was saved. This was due in part to the assistance given by the steamer from White River Junction but more especially to the fact that it was about the only building in town that did not have a wooden shingle roof. It was a frame building two stories in height with a mansard roof. The top was covered with sheet metal and the mansard with slate. If this building had been covered with wooden shingles the chances of saving it would have been very small.

The most striking lesson of the Canaan conflagration is the well-known lesson of the wooden shingle. If this village had not been cursed with the shingle roof menace, it would probably have been saved.

This is a lesson that should be taken to heart by the many people who are still fighting against the abolition of highly combustible roof coverings. These include many lumber dealers, architects, and building owners. They claim that the danger from shingle roofs is not of importance compared with the expense and trouble involved in substituting safer materials and also that shingles are more artistic and attractive. A trip to the homeless and stricken people of Canaan in June, 1923, would have convinced the most prejudiced to the contrary.

The remedy is building laws that do not allow wooden shingles on new buildings and allow only a small percent of old roof to be repaired with these conflagration breeders.

Automatic Sprinkler Tests.

By Tennessee Inspection Bureau.
(Member N. F. P. A.)

Tests of an eight head automatic sprinkler branch line were conducted by the Tennessee Inspection Bureau in June, 1923, to determine the pressure and discharge from each sprinkler head with the line installed in accordance with present standards. As a result of these tests it was shown that with the minimum required pressure applied (12 pounds) the discharge from the last two heads is ineffective.

The sprinkler line was constructed of new steel pipe, properly reamed, and sized in accordance with present standard practice. Standard sprinkler fittings were used and the heads were "Manufacturers" 1920 (with deflectors and frame removed to facilitate measuring the discharge), spaced 8 ft. 1½ in. on centers.

The line was fed by a fire hydrant through a gate valve and 2½ in. pipe, having 45 degree elbows to minimize disturbances. The line was arranged to twist so that the discharge could be thrown into calibrated measuring tanks for a specified time and then thrown out. The time was measured with a split second stop watch. Midway between the heads gauges were attached to the pipe.

Procedure.

Tests with all heads discharging were conducted at pressures ranging from 5 pounds to 55 pounds. The discharge from the heads (which were the usual ½ in. ring nozzle type) was measured by collection in the measuring tanks (accurate to ¼ gallon), and the pitot pressure* at each head was also taken. The gauges between heads were read and all gauges were calibrated before and after the tests.

Tests were made at 12 pounds pressure with the first two heads plugged and also with the last two heads plugged. Tests showing peculiarities were repeated until accuracy was established and numerous additional tests were made to compare actual measured discharge with pitot readings.

Tests with all heads open were made at pressures of 5, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, and 55 pounds.

*Pitot pressure is the pressure determined by using a pitot tube to measure the flow of the water through a small orifice.

The standard eight head branch line when supplied with the minimum allowable pressure of 12 pounds. Note the feeble action of the last two heads.

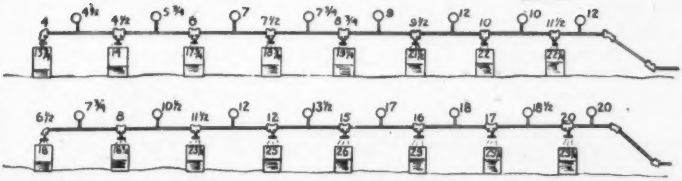
Conclusions.

As a result of these tests, it was evident that with the minimum required pressure applied (12 pounds) the discharge from the last two heads was ineffective (4½ and 4 pounds pitot pressure, respectively). In this connection it should be considered that in these tests heads were 8 ft. 1½ in. apart, whereas 12-foot spacing is permissible by present standards under certain conditions, in which event the pressure at the end heads would be even less.

From observations during the tests it is believed that the minimum pitot pressure at which moderately effective distribution can be obtained is 6 pounds. However, this feature should be decided by tests under all types of ceilings.

There are several ways by which the effectiveness of the last heads could be increased.

1. By using sprinklers having orifices graduated in size, to throttle down the discharge of heads near the riser. This would require several sizes of sprinklers and involve installation difficulties.
2. By retaining present heads and pipe sizes and increasing minimum allowable pressure from 12 pounds to 20 pounds. This will produce 6½ pounds on the last head. This method, which is the one that could be put into effect for future installations most



Picture diagrams showing the readings at pressures of 12 pounds (upper diagram) and 20 pounds (lower diagram). The figures below the heads indicate the discharge from each in gallons per minute, the figures above the pipe indicate the pressures at the heads and at the gauges between heads in pounds per sq. in.

readily, is palliative only and does not overcome the objectionable feature, which is that excess pressure and discharge must be maintained at the first heads to provide for effective operation of the last heads.

3. By increasing pipe sizes so that with 12 pounds supplied, the pressure at the last head will be 6 pounds. Computations based on values obtained in these tests indicate that a line giving practically uniform drop from 12 pounds to 6 pounds would be sized as follows: 1-inch, 1¼-inch, 1½-inch, 2-inch, 2-inch, 2½-inch, 2½-inch instead of ¾-inch, 1-inch, 1¼-inch, 1½-inch, 1½-inch, 2-inch, 2-inch as at present.

The ideal solution of the problem is one that will provide a uniform discharge from each head on the line. This can be attained by:

1. Increasing pipe sizes to such a point that frictional loss is practically negligible, or by gridironing the system to produce the same effect.
2. By using sprinkler heads with throttled orifices at locations where the pressures are high. In this connection we suggest the possibility of developing a sprinkler head or fitting having a curved or tapering throat of such design that the discharge will be fairly constant at the lower range of pressures.

Numerous features encountered during these tests indicate the desirability of further investigation. In fact, before any intelligent decision can be reached it will be necessary to determine the required pressure at the head to give effective distribution under the various types of ceiling construction.

Fighting Fire in a Cargo of Sisal.

Readers of the QUARTERLY will probably recall the interesting investigations conducted by Underwriters' Laboratories on the properties and hazards of sisal. The results of these tests were reported in the January, 1922, QUARTERLY, page 241. The peculiar problems encountered in fighting fire in bales of sisal are well illustrated by an entertaining account of a sisal fire on shipboard by Mr. Colin McKay in the June, 1923, issue of *Marine Review*. The story is as follows:

What should a shipmaster do in case of fire in a cargo of hemp? Lift his hatches and try to deal with it directly, or keep on his hatches, close his ventilators and all other openings and try to smother the fire with live steam.

The following yarn of how one shipmaster attempted to deal with the problem may be of interest; and it may serve a good purpose if it leads others to relate their experiences with fire at sea.

Captain Bates, as I shall call him, was a fine type of the British shipmaster. He held an extra master's certificate, and had sailed all kinds of craft from full rigged ships to passenger liners. During the war he had a rather exciting career and finally went down with his ship, sunk by a submarine.

Fire Is Discovered.

A dozen or more years ago he was in command of a 5,000-ton steamer, trading to Mexico. I was then second mate with him. On the trip we had the fire, we loaded sisal, or Mexican hemp, at Progreso. We had frequently handled this cargo before, and while loading always had notices posted up forbidding smoking on deck. The stevedores were very strict with the longshoremen who knew very well that smoking below would endanger their own and their fellow's lives, as the dry fiber blazes up sometimes like gunpowder.

We loaded from lighters about three miles off the beach, and as a "norther" on the Yucatan bank is not pleasant, usually worked steadily until finished. We had four officers and two cadets, and there was always an officer tallying the bales going into the two hatches forward and another officer looking after the two hatches aft. Incidentally the officers took note of anybody violating the rule against smoking on deck. This trip, the ship's surgeon was fined, much to his indignation, as he had not been near the open hatches.

We left Progreso about midnight, and 48 hours afterward when a man came to the poop to call me for the middle watch, he said there was a smell of smoke about the after deck. I told him to put his head in the ventilators. By the time I had my clothes on he was back, saying there was fire in No. 3 hold.

I went along myself, sniffed at the ventilators leading to No. 4 hold, smelt nothing, and then tried the ventilators leading to No. 3 hold. I smelt smoke or some kind of gas, but couldn't see anything emerging from the ventilator.

"Call the mate and all hands," I said "and tell the watch to come along with the storm covers of the ventilators."

I turned the cowls of the ventilators back to the wind, and went along to the old man's cabin near the bridge.

"There's fire in No. 3 hold, sir," I said, knocking on his door. "All right, I will be out in a minute," he answered calmly, instantly awake. Going aft again I was soon joined by the watch, and we lifted off the cowls of the ventilators and put on the storm covers which were waterproof if not air-tight. Then I told the men to hustle along the deck hose and some electric light clusters and notify the engineers.

The steamer was then plowing up the gulf stream about abreast of the last of the Florida keys; running along under a starlit night over a sea scarcely stirred by the light easterly breeze.

Captain Bates and the mate soon appeared and when the deck hose was laid and the electric clusters shining, a corner hatch was lifted. A whitish smoke hung in the hatchway, but there was no glimmer of flame. Presently the smoke began to ascend lazily, and we closed the hatch again.

The old man's position was difficult enough. If he opened the hatches the fire might be fanned by the in-rushing air to a disastrous blaze. If he kept on his hatches, it might still smoulder and do a lot of damage, and the owners and underwriters might ask why he did not fight it directly. In the end, the need of action, of being able to say that he had grappled directly with the danger, that and curiosity—the desire to probe the mystery beneath the blanket of smoke and to know the worst—decided him to try to get at the fire.

We took off the hatches and the smoke soon cleared away. In the upper 'tween deck there was only one layer of sisal bales. On the port side was the refrigerator chamber and on the starboard side a magazine extending the length of the hatchway. When we ventured below we found that a thin trickle of smoke was oozing from the crack of the magazine door, but there was no sign of smoke or fire anywhere else.

We rigged up the derricks and removed the single tiers of bales, which weighed about 250 pounds, from the 'tween deck hatch, stowing them in the empty space farther aft. Then we got a spare tarpaulin,

wet it, and laid it over the hatches of the 'tween decks with one end forming a carpet to the door of the magazine.

Opening the door of the magazine we saw no sign of flame, and the amount of smoke that came out was insignificant. But it was enough to indicate the presence of fire.

We began to hoist the bales out of the magazine and up on the main deck. Some showed signs of fire—slight scorches on tufts of fibre—and when these were opened on deck they usually burst into flame, as if the fire had been smouldering in the tight packed heart of them. The deck hose soon extinguished the flames.

We kept a careful watch for the beginning of a blaze in the magazine, and, because of the acrid gas which hung inside, used relays of men working there. But we had no blaze below, though a dozen scorched bales when opened on deck burst into flames.

After two hours hard work, we cleared the magazine, and then rolled away the tarpaulin and lifted some of the 'tween deck hatches to look at the bales below. No sign of smoke, no smell of fire. We went on deck.

Captain Bates was smiling broadly, and everybody was in high fettle. Grog was served and we congratulated ourselves on a fine night's work.

"Put on the hatches the watch, the rest can go below," said the mate.

While I was going toward the bridge to relieve the third mate who had been there six hours, the ship was suddenly enveloped in a great flare of light, and turning aft I saw a great geyser of flames rising from No. 3 hatch, shooting up as high as the eyes of the main rigging.

After a few minutes, the bonfire died down, having eaten up the air in the hold, but the flames continued to billow in the hatchway. Three streams of water were turned into it, and we started to put on the hatches. Several times the flames soared high, but we finally got the hatches on and the tarpaulins spread, with the three lines of hose under them, so that the water would run between the interstices of the hatches and down on to the fire.

We were astonished and annoyed. "Well, I would never have believed it if I had not seen it," said the old man. "If that infernal blaze had burst out when the men were below—" He turned to pacify a number of excited passengers who had been aroused by the flare of light shining in their stateroom windows.

Overcome by Gas.

The steamer plowed up the gulf stream, bilge cocks open until there were 12 feet of water in No. 3 hold. Then she took an ugly list and the pumps were started until she righted again. The engineers broke a joint of the steam pipe leading to the after winches and connected it with a pipe introduced into the hatch. Several carboys of ammonia were taken

from the refrigerator plant, and thrown into the hold with their cap valves open. When a hatch was raised for this purpose the flare of fire was visible.

The steamer headed for Newport News, with the water from three lines of hose pouring through her hatches and a pipe throbbing with the pressure of steam rushing into the hold. We watched the hatch and the deck temperature, and kept an eye on the ventilators of No. 4 hold, fearing the sisal there would be fired by the heat of the bulkhead.

The morning after the discovery of the fire, the second steward went into the refrigerator chamber for the day's supplies. He dropped at the foot of the ladder. Another steward went and he dropped. A cry of alarm brought an officer who realized that gas from the fire had got into the refrigerator. The unconscious men were fished out. The doctor had a job to bring them around, and they were very sick for a few hours. We had no fresh provisions that day.

About three days later we anchored at Newport News, and two fire tugs and a lighter came alongside. The fire tugs pumped water into the hold until she took a list. Then we began to discharge the sisal into the lighter, where the bales were broken open.

And in spite of water, ammonia and steam, hundreds of bales had fire in the heart of them and blazed up as soon as opened. Even some of the bales which were under water when the lower hold was flooded had fire in them.

An authoritative explanation of the fire was never forthcoming. It was conjectured that the heat of the engine room bulkhead might have caused it, but the ship had carried a dozen or so cargoes of sisal without mishap. During the fire, the deck became rather hot and presumably the after bulkhead too, but there was no trouble in No. 4 hold. Possibly it started from spontaneous combustion, but if so, it was an exceptional occurrence.

The actual amount of sisal burned was insignificant. While the fire ran along some fibers like powder, it ignored others. Apparently when it found a fiber to its liking it ran right into the heart of the bale in preference to burning its neighbors. And possibly the penetration of the water through the apertures the fire must have made, was interrupted by the swelling of the fibers. But how the fire managed to smoulder in the heart of bales completely soaked on the outside is a mystery.

Rural Fire Protection in Brunswick, Maine.

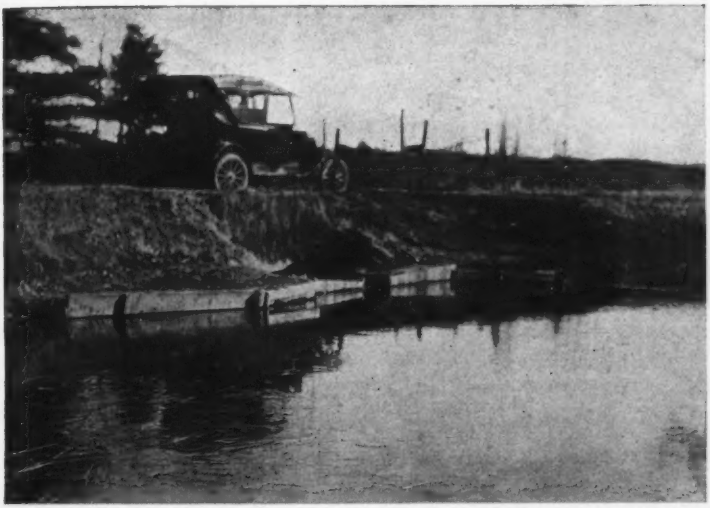
By S. E. Conner.

Brunswick, Maine, was the first city in New England to set about providing its rural section with efficient fire protection. This it has done during the past eighteen months and at a cost of less than $2,000 to the tax payers. It is an example that practically any municipality having a rural district and a village or city fire department can follow with a correspondingly moderate outlay.

The plan previously followed in Brunswick, as in most other communities, was to tax the farmer to help maintain the city fire fighting force and let him get such benefits from it as he could. The benefits were usually negligible, even after the department became completely motorized, as in the majority of cases the only source of water supply for the pumpers was the farm well which usually went dry in five or six minutes. After that all the firemen could do was to save as much stock as possible and stand around and watch the fire burn.

The logical plan for improving this situation was to make available to the pump a sufficient supply of water comparatively near to groups of farm buildings. A survey of the local situation was made by the fire chief and twenty-seven strategic locations were selected. Points were located on sixteen brooks where the pumper could be stationed and used effectively. Eleven of these were easily available from the main highway. At the other five a short stretch of road had to be constructed. At the other eleven locations selected, artificial reservoirs were created by constructing dams on small brooks, which would otherwise have been valueless as a water supply in case of fire. Nine of the dams were built of concrete, two of wood. Roadways were constructed where necessary and a suitable landing spot for the fire apparatus was provided.

All the farmers whose places came under the protection of one of these artificial reservoirs were enthusiastic over it. This was a factor in keeping the cost down, for many of them contributed labor both of themselves and their horses, as well as material for use in the work. In most instances the ponds created by these dams were made larger than originally contemplated, by request of the farmers. The reason was that in winter they could utilize them as a source from which to harvest the year's supply of ice for use on the farm.



One of the artificial ponds created in Brunswick, Maine, to provide fire protection for farm property. Note how accessible the pond is to the main road.

The most distant of these reservoirs can be reached by the motor pumper in fifteen minutes from the time an alarm is received at the central station. Not only does this time cover the run, but the laying of five hundred feet of hose and putting water through it. During the winter months this time, of course, would be increased, as horse drawn apparatus must be used in the deep snow.

Under this system of rural fire protection seventy-four buildings in Brunswick and the adjoining town of Harpswell are covered. Three churches, a saw mill and two public halls are also protected.

A Fire Engine for Farmers.

By William Draper Brinckloe.

Architectural Editor, The Farm Journal.

Talbot County, Maryland, is my home, and I think it's the garden spot of the whole United States. However, there was one drawback—there was no fire protection whatever for us rural folks. We have no large cities; the county seat, Easton, is a town of about 3,500, and has only one good fire engine. Naturally, the town folks object to letting this single engine go out into the country; it would leave them at the mercy of any sudden blaze.

Organizing a Committee.

About a year ago, several of us decided that there ought to be a fire engine for the rural folk; we got together and organized the Talbot County Fire Engine Committee. Our idea was to get a combination chemical and water-pumping outfit, mounted on a speedy auto truck, and place this at some central point ready to answer all telephone calls for help.

Easton, the county seat, is right in the middle of the county; so we decided to locate the engine there. We interviewed the local fire company, and found it would be quite willing to house and man the engine. It was agreed that the company would have the right to use it at any town fire, but we stipulated that should a rural call come in, this engine must leave the town blaze and go out into the county. However, the chance of such a call, at such a time, would be very slight; so the town would have, practically, the use of an extra engine all the time, which would mean lower insurance rates.

Considering this, we went to the Easton Town Council, and secured an appropriation of $500. Next we went to the County Commissioners, and got $500 from them.

Asking All to Help.

Then we went after the people. We organized small local committees all through the county, and set these committees at work, securing subscriptions from the farmers. We had circulars printed, explaining the situation, and asking for money. These were mailed to a large list of possible subscribers. "Please send check to our treasurer"—so the circulars ran—"or, if not convenient to pay the money now, please sign and send in the enclosed pledge." We found, by sad experience, that a

mere verbal promise to give a certain amount didn't mean much; but a man will very rarely go back on his signed pledge.

It was rather hard sledding. "Oh, there's no water on my place, except the well," said one man. But we explained that the engine would carry a large chemical tank, that would work for at least fifteen minutes, throwing a chemical stream equal to a large stream of water. Also, this tank was so equipped that it might be kept filled by a bucket brigade, from a well or cistern; and, after the chemicals were exhausted, a fair-sized water stream could be kept playing on the fire. Of course, if any pond or brook were within a thousand feet of the fire, the full-sized pump, driven by the engine of the automobile, would be used, throwing a stream equal to that from a city fire engine.

Another objection was, "Oh, it couldn't get to my place in time to do any good, especially when the roads are bad." But we pointed out that just a few days before, a farmer's barn had caught fire, with the wind blowing toward his house; a bucket brigade kept the house wet, but after some time the roof caught in spite of all they could do. Just at that moment, the town fire engine arrived, after a long, hard drive, and saved the house. However, the insurance people objected because the engine had left town; therefore, the town council passed an ordinance, forbidding it to do so in the future. As to the roads, we explained that the engine could go anywhere that an automobile could.

And so, by hard work, we raised the money and ordered the engine.

The Mayor and Council of Easton hold title to the engine, for a period of five years, with the stipulation that rural calls shall have the preference. The County Commissioner and the Mayor and Council have agreed to share the maintenance charges equally. At the end of the five-year period, a joint committee of citizens is to be named by the Mayor and Council and the County Commissioners; this committee to have power to renew the existing agreements, or to make others.

The engine has been in service several months, and has already saved many thousands of dollars worth of rural property. In many cases it has arrived in time to extinguish the fire before serious damage has occurred. In other cases, it has saved surrounding property.

A very valuable result of our County engine campaign has been the awakened interest in fire protection among the rural and small town folk. A number of persons have attached fire hose to their water systems, and also purchased fire extinguishers. The small towns are considering the purchase of hand-drawn chemical outfits, to hold a fire until the arrival of the County engine.

Still more recently, the Easton fire company received the gift of a second-hand automobile. With the help of various local people, the fire-

men raised $1,700, and used the money to equip this as a chemical engine and hose truck.

This outfit is the property of the volunteer fire company, and is to be used for rural as well as town fires. It will leave ten minutes after the County engine, thus permitting additional firemen to reach the engine house and be carried to the fire. In case of an inland blaze, where no large quantity of water is available, the chemical tank on the County engine will operate for about fifteen minutes; by that time, the firemen's chemical will arrive and go into service. Then the County engine chemical will be re-charged, using water from the nearest well or small stream, and will be ready by the time the other tank is exhausted.

A rather interesting result of the County engine's work has been the creation of more friendly relations between the town of Easton and the rest of the County. The rural districts did not understand the previous situation. The committee was frequently told that "the engine won't answer country calls; those town fellows won't let it go!" But this has been completely disproved; and the farmers are loud in their praises of the Easton firemen.

The Suva Conflagration.

A serious fire occurred during the night of February 10, 1923, in Suva, the principal city of the Fiji Islands. The following rather quaint account of the fire is extracted from the columns of *The Fiji Times and Herald,* issue of February 12.

How can we best describe the happenings of Saturday night? It would take the pen of an artist to depict the scenes.

About seven o'clock the fire bell rang out its strident warning, and, in a moment all eyes were focussed on a huge spiral of smoke, illuminated by a big red glow beneath. The first cry everywhere was "It's Marlow's." Happily it was not, for if the sawmill had gone, practically all Suva would have followed into the discard.

Arriving on the scene within five minutes of the bell's alarm, we found the fire nearly half an hour old. The scene in Renwick Road was one never to be forgotten.

The fire originated in the two-storied tenement house, on the North side of Cumming Street, owned by Mr. Peter Grant, and tenanted by one Mithu. The premises were used as an Indian boarding house upstairs and a kava "joint" below.

About 10 minutes to 7 o'clock, it is said, a woman in one of the back rooms on the first floor was endeavoring to light a primus stove with a piece of rag, saturated with benzine. As it had not heated sufficiently she applied the bottle of benzine to the burner, and, needless to say, it at once exploded. Dense masses of smoke soon poured from the windows, followed by flames.

Mr. W. Nicholson and Mr. J. Jones, who both live in Stewart Street, on rising ground to the north of Cumming Street, both saw the smoke at the same time and rushed to the scene. Mr. Nicholson reached the hydrant close by and a few minutes later the fire reel with a length of hose under Inspector Tucker arrived. The hose was too short and there were no couplings. More hose and then no nozzle. When the nozzle finally arrived, there was no pressure in the main, and the supply was useless to put out a fire. Meantime the flames made rapid headway and the adjoining building was in flames, which then leapt across the street to the other side.

Everywhere the many coloured denizens of Cumming Street swarmed out, like bees out of a hive. As one entered Waimanu Road from Renwick Road, there was a mad torrent of maddened people. Seldom have we seen so mad a crowd. The worst were the Chinamen, who as a race very gravely dread fire. The Chinese fairly screamed as they rushed out

Data furnished by courtesy of David W. Amos (Member N. F. P. A.), General Manager, The Pacific Insurance Company, Ltd., Suva.

of the burning street. In almost every case they carried boxes with their personal treasures. Indians came a good second. They rushed along, like the Chinese, also carrying boxes and other things. The "other things" materialized later into sewing machines, bedding, and finally the wonderful assortment of a general store or stores. All that could be snatched from Cumming Street was recklessly dumped in Renwick and Waimanu Roads.

Later, as the fire crept along towards Thomson Street, the dumping of goods cluttered the bridge, on which some tons of clothing and groceries and hardware and everything were cast in a heap.

Suva's colored population reaped a "harvest of pillage," which we hope will never be witnessed again in Suva. Goods lay everywhere. It was ghastly in its allurement. For years after every fire, we have pleaded for police organization and a salvage corps. We are safe in saying that, on Saturday, half the goods salvaged were stolen. We saw children running off, each holding a tier of one to two dozen children's felt hats. Natives disappeared into corners and reappeared with as many as four new singlets or shirts on, and no one said them nay.

The whole disaster was distinguished by ineptitude, impotence, and stupidity. Under no conditions on earth could a more helpless state of things exist. We have not, in the English language, words to describe the utter lack of preparedness. That was the opinion of every man and woman one met on Saturday night.

How or when the so-called fire brigade arrived we know not. In any case it was a joke—a grim one truly, but yet a joke.

When the fire brigade arrived no one seemed to know, and few seemed to care. There was no stopping the fire. The puny equipment was a child's toy.

Europeans early on the scene are unanimous that, if there had been an ample supply of water at the commencement of the outbreak the damage would have been confined to the block where it originated. At the start there was only the small domestic supply available, quite inadequate, although it was increased later. At 11.30 the reservoir was empty and the effective supply was cut off.

The fire darted across the road and ate up the wooden buildings opposite. Going westward the conflagration was happily stayed by an empty space. A large concrete building offered a barrier on the east. It withstood the fierce heat, although the windows were damaged to some extent. Dense showers of sparks which floated over the town were a constant source of danger and boys armed with buckets of water were kept busy for hours protecting roofs. Meantime the fire raged on the south side. At this time many premises could have been saved if dynamite had been used. When too late, everyone talked of dynamite. It is always so in Suva. Some day we will wake up.

Some twenty buildings were destroyed by the fire. The loss is estimated at £40,000. There was no loss of life although several persons received injuries.

Hazards of the Meat Packing Industry.

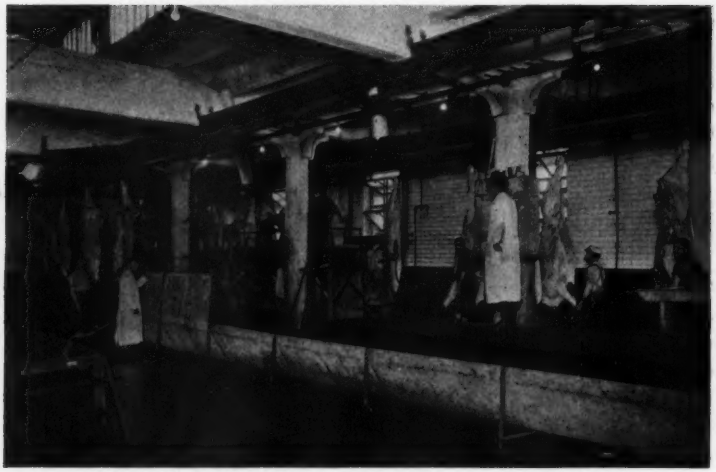
By George L. Raymer.
(Member N. F. P. A.)

The modern meat packing establishment is a comparatively recent development and had its origin in the local abbatoir—the unsavory slaughter house of boyhood recollection. The industry as we know it today has grown up since the Civil War. In 1865 every town or city had its slaughter house. New York City had more than two hundred, and what is now Fifth Avenue was often encumbered by large droves of cattle. Great stockyards occupied territory that now provides sites for clubs, hotels and the highest class of retail stores.

From this rude beginning the business expanded with the rapid increase in city population incidental to development of factories and other commercial activities. It became necessary to provide cold storage facilities for fresh meats, at first kept at proper temperatures by ice, later by mechanical refrigeration. Other processes have been added from time to time until the modern packing house manufactures not only meats, lard, sausage, etc., but also other products, such as beef extract, oleomargarine, canned meats, glandular extracts for medicinal purposes, pepsin, fertilizer, curled hair, glue, and in some cases soap, glycerine, sand paper, gut for "fiddle strings" and tennis raquets, and other items too numerous to mention, some of which to the uninitiated might appear to have little relation to the original business of slaughtering animals and preparing the meat for sale.

It was also necessary to build refrigerator cars for distribution of perishable products, and to provide box factories, cooperage works, tin can factories, machine shops and other facilities to furnish necessary supplies, until a present day packing house is a combination of a great many different industries and processes in one plant.

The early plants were largely of frame construction, and additional buildings were added from time to time to take care of the rapidly expanding business. Cold storage buildings were insulated by filling the spaces between the studding with sawdust and shavings. Very little in the way of segregating hazards with proper cut offs was attempted as the science of fire protection had not at that time been developed. Fire protection was entirely lacking or inadequate and it is no wonder that the industry earned for itself a rather unfavorable fire record.



Dressed beef leaving killing department for coolers.

All this has been changed in the modern plants. Buildings are of brick with heavy joists or of fire-resistive construction; insulation is of cork board with cement plaster finish; hazards have been segregated and cut off and unusually effective fire protection has been provided. The nature of the business requires enormous quantities of water in its operation, and it is not unusual to find pumping facilities ample to supply ten to twenty thousand gallons of water per minute at a single plant. Automatic sprinklers are common, and in some cases interconnecting mains have been laid between the several plants in one city, making possible enormous concentration of water at one point.

While some of the fire hazards of the industry are severe, and on account of the concentrations of large values in packing plants, fires in this occupancy may be of very serious extent if not properly controlled, on the whole it may be said that the hazards of the modern plant are fairly well safeguarded by the exercise of constant vigilance in the matter of good housekeeping and in the maintenance of automatic sprinklers and other fire protection devices.

Fire hazards of the industry are too well understood to require more than brief mention. The slaughtering buildings are usually of fire-resistive construction and since the process is very wet, no hazard is presented except the usual hazards of light, heat and power. Good housekeeping, especially in the dressing rooms where work clothing is kept, is about the only fire prevention precaution required in the slaughtering buildings.

Cold storage buildings for fresh meats and meat curing present no hazard beyond the usual light and power and heat for scalemen's offices.

Fires in such buildings are usually hard to handle on account of the absence of windows and the few doors, and it is essential that good care and order be maintained especially in dressing rooms.

Rendering of lard and grease is done in steel tanks under steam pressure. These tank houses present a severe grease hazard and should be of fire-resistive construction. The hazard of lard refineries consists of quantities of melted lard in open iron tanks. A fire in these, once having gained headway, is difficult to handle.

Smokehouses involve a considerable hazard for the walls soon become coated with greasy soot which is likely to be ignited in case a sudden draft in the firing pit causes sparks to ascend in the smokehouse. These fires are ordinarily not severe as the smokehouses are quite small and a fire in one house does not endanger any of the adjoining houses. Automatic sprinklers are very effective in extinguishing smokehouse fires; the writer does not know of any case where a sprinkler equipped smokehouse had a fire which resulted in any loss.

Tankage, used as a basis for fertilizer, is made of the residue from rendering tanks. After having the excess moisture removed in hydraulic presses it is passed to dryers of the steam or of the direct flame type, after which it is stored by piling loose in storage buildings. Fires caused by spontaneous ignition of imperfectly dried tankage, or piling this material while hot, are of frequent occurrence, but like picker room fires in textile mills, very rarely assume any importance. The material is slow burning and sprinklers handle such fires perfectly.

Glue is extracted from bones, hide trimmings, etc., in closed tanks under steam pressure and after slicing is dried in "tunnels" by large fans circulating air at ordinary temperatures. The principal hazards of the glue department are those of heat, light and power.

Beef, extract, glue, and other similar products are reduced by boiling in vacuum pans. The hazard of this process is found in radiated heat from vacuum pans, steam piping, etc. The usual common hazards are also present.

Box factories in packing plants are usually limited to nailing box shooks into boxes. Cooperage is usually confined to recoopering without the use of barrel heaters, etc. The hazards of box making and cooperage are the same as those of similar plants under separate ownership.

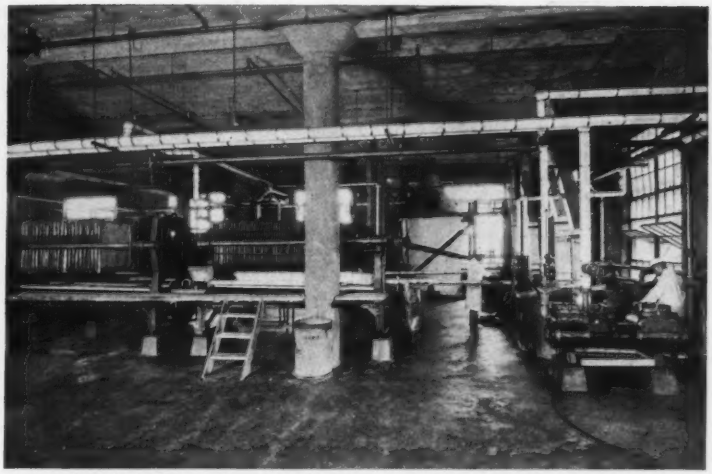
About fifteen or twenty years ago the packers began the installation of automatic sprinkler equipments. There was a good deal of speculation at the time as to whether sprinklers would handle fires in the more hazardous locations, but experience has proven that where proper maintenance is given the equipment, fires are extinguished by automatic sprinklers with the same efficiency as in any other class of property. A careful

Sheep Coolers.

record has been kept of the fires in the various plants of one of the large packers and out of over one hundred fires reported only three resulted in insurance claims. The sprinklered "loss ratio" of this concern, covering seven sprinklered plants, is less than one per cent of the premiums. The sprinklers were installed in the first of these plants in 1906 and the record covers some 90 "plant years".

Maintenance of sprinklers in packing houses presents a good many difficulties not met in the ordinary factory or warehouse property. In some departments, notably the "tank house," glue cooking rooms and to a lesser degree in meat curing cellars, corrosion is bad and piping protected only by paint will require frequent renewal. It has been found that coating the pipe with a heavy asphalt paint and wrapping with cheese cloth with another coat of the same paint applied over all furnished very effective protection. Sprinkler heads must be wax coated and inspected frequently to insure that the coating is intact. As soon as hair line cracks develop in the wax coating heads should be taken out and wax removed by washing in a suitable solvent. After thorough cleaning, heads may be recoated and put back into service.

The piping of dry systems in "sharp freezers" might under extreme conditions become filled with ice owing to condensation of moisture in the air used for filling and precautions should be taken to minimize the amount of moisture introduced into the system in this way. By keeping the system as free from leaks as possible so as to require a minimum amount of air to maintain the pressure and by taking for the air pump



Lard Refinery showing filter presses, lard tanks and pumps.

suction cold dry air as far as possible, trouble with ice caused by the freezing of moisture introduced with the air may be avoided. A large dry system will contain approximately 100 cu. ft. of air. To bring the pressure of the air in the system up to 45 lbs. would require 300 cu. ft. of air under atmospheric pressure. Assuming that this air were completely saturated with moisture and had a temperature of 65° F., filling the system would introduce less than ½ lb. of water. The conditions of this assumption would result in trouble from ice if frequently repeated during a period of years. Such conditions, however, are extreme, and should not be encountered in ordinary practice. Frequent inspections by the writer have failed to show stoppage of piping from this cause, and in all cases where piping has been found to contain ice, it has been possible to show by examination of the valve records that the system has been accidentally tripped and not properly drained.

To insure proper service from dry systems in freezers, the following precautions should be observed:

1. Carefully watch the air gauges to prevent as far as possible accidental tripping on account of low pressure.
2. Keep systems as tight and free from leaks as possible.
3. Should the system be tripped, open drains as soon as possible to get the water out before it freezes. Take heads off the end of all sprinkler lines and run the air compressor to be sure that there is a free and unobstructed passage from the dry valve to the ends of all lines.

To sum up, a packing house presents some severe hazards, but reference to a carefully kept record of fires shows that sprinklers will extinguish without difficulty fires in the most hazardous departments if properly maintained, and while maintenance presents problems not present in other factories they are by no means insurmountable. Fire prevention in this industry is a question of recognition of the hazards and difficulties and then taking the proper steps to overcome them.

Packing Houses — Fire Record.

The fire record of the meat packing industry, compiled from reports of 503 fires recorded in the N. F. P. A. files, substantiates the conclusions of Mr. Raymer in his article on another page of this QUARTERLY, that the present day packing house is a combination of many different industries in one plant. The division of causes into 186 fires from common, 218 from special hazard and 109 from unknown causes perhaps deserves no special mention, but the diversity of the special hazard causes and the large number of different room or department occupancies in which fires occurred may be cited as proof of the above-noted conclusions. In the table entitled "Room in Which Fire Occurred" there are listed 30 different rooms or departments, and there were 36 additional rooms or departments grouped as "Miscellaneous," in each of which one fire occurred, making a total of sixty-six different occupancy sub-classifications in which fires occurred.

In the list of special hazard causes, smoke house fires constitute 72.5 per cent of the total. Ignition of grease or soot in the smoke house is an ever present hazard, but is usually so recognized and safeguarded that such fires rarely assume serious proportions. After smoke house fires, the next most important special hazards are incident to the by-product phases of the industry. The dryer and grinder fires listed in the special hazard table were for the most part in fertilizer departments, as were also the dust explosions and "spontaneous ignition of fertilizer." The picker fires, which come third on the list, were in hair pickers, another special hazard incident to the utilization of by-products.

Comparison of the amount of losses in sprinklered and unsprinklered property conclusively demonstrates the value of automatic sprinkler protection in this occupancy. Because of the large amount of sprinkler piping exposed to low temperatures in refrigerated spaces, the dry pipe sprinkler system predominates, being found in 155 of the 185 sprinklered fires recorded. The efficiency of the dry-pipe systems in packing houses is 96.3%, which may be compared with 93.4%, the average efficiency of

dry-pipe systems in all occupancies. (See QUARTERLY, April, 1923, p. 406.) This speaks well for the character of the maintenance accorded sprinkler systems in this occupancy, in the face of the difficulties which Mr. Raymer describes.

Packing Houses.

(Total Number of Fires Reported, 513.)

Classification of Causes.

COMMON CAUSES.

	No. of Fires	Per Cent of Common Causes	Per Cent of Total Known Causes
Power	42	22.6	10.4
Spontaneous Ignition	41	22.0	10.1
Matches—Smoking	24	12.9	5.9
Heating	22	11.8	5.6
Incendiary	13	7.0	3.2
Boiler Sparks	9	4.8	2.2
Defective Electric Wiring	8	4.3	2.0
Rubbish	6	3.2	1.5
Open Lights	6	3.2	1.5
Locomotive Sparks	4	2.2	1.0
Exposure	4	2.2	1.0
Defective Chimneys	4	2.2	1.0
Lightning	3	1.6	.7
Total	186	100.0	46.1

SPECIAL HAZARD CAUSES.

	No. of Fires	Per Cent of Special Hazard Causes	Per Cent of Total Known Causes
Smoke House Fire (ignition of grease or soot)	158	72.5	39.1
Overheated Dryer	16	7.3	4.0
Picker Fire	8	3.7	2.0
Dust Explosion	6	2.7	1.5
Spontaneous Ignition of Fertilizer	5	2.3	1.2
Gasoline Singeing Torch	4	1.8	1.0
Foreign Substance in Grinder	3	1.4	.7
Ignition of Grease in Baking Oven	3	1.4	.7
Inflammable Liquids	3	1.4	.7
Ammonia Explosion	2	.9	.5
Sparks from Refuse Burner	2	.9	.5
Miscellaneous	8	3.7	2.0
Total	218	100.0	53.9

	No. of Fires	Per Cent
Common Causes	186	36.3
Special Hazard Causes	218	42.5
Total Known Causes	404	78.8
Unknown Causes	109	21.2
Total	513	100.0

Room in which Fire Occurred.

	No. of Fires	Per Cent of Total with Data
Smoke House	173	38.5
Storage Room	29	6.4
Drying Room	22	4.9
Fertilizer Room	17	3.8
Boiler Room	17	3.8
Locker Room	14	3.1
Lard Rendering	13	2.9
Hair Department	11	2.4
Roof	9	2.0
Cooler	9	2.0
Yard	9	2.0
Motor or Engine Room	9	2.0
Office	8	1.8
Slaughter House	8	1.8
Tank Room	8	1.8
Elevator Shaft	8	1.8
Laundry	6	1.3
Retail Store	6	1.3
Singeing Room	5	1.1
Sausage Making	5	1.1
Packing Room	4	.9
Cooperage	4	.9
Shipping Room	3	.7
Beef Cutting	3	.7
Canning	3	.7
Refrigerator	3	.7
Kitchen	2	.4
Pump House	2	.4
Hide Room	2	.4
Laboratory	2	.4
Miscellaneous	36	8.0
Total with Data	450	100.0
No Data	63	
Total	513	

Sprinkler Fire Record.

	Wet System	Per Cent	Dry System	Per Cent	Total	Per Cent
Extinguished Fire	19	63.4	109	70.4	128	69.2
Held Fire in Check	11	36.6	41	26.4	52	28.1
Total Satisfactory	30	100.0	150	96.8	180	97.3
Unsatisfactory	0		5	3.2	5	2.7
Total	30		155	100.0	185	100.0

There were 56 fires in which no sprinklers operated.

Number of Heads Opening.

	No. of Fires	Per Cent
1	53	28.6
2	32	17.3
3	17	9.2
4	18	9.7
5	9	4.9
6-9 incl.	22	11.9
10-25 incl.	18	9.8
26-50 incl.	6	3.2
51-100 incl.	5	2.7
Over 100	3	1.6
No Data	2	1.1
Total	185	100.0

Miscellaneous Statistics.

Analysis of Loss.

	Sprinklered Fires	Per Cent	Unsprinklered Fires	Per Cent	Total	Per Cent
Small Loss ..	221	91.7	145	53.4	366	71.4
Large Loss ..	19	7.9	107	39.3	126	24.5
No Data	1	.4	20	7.3	21	4.1
Total	241	100.0	272	100.0	513	100.0

Large loss fires are fires causing loss of more than $5,000.

Time of Day.

	No. of Fires	Per Cent
6 A. M. to 6 P. M.	209	40.8
6 P. M. to 6 A. M.	292	57.0
No Data	12	2.2
Total	513	100.0

How Discovered.

	No. of Fires	Per Cent of Total with Data
Employee	168	36.9
Watchman	122	26.9
Sprinkler Alarm	70	15.4
Sprinkler Alarm and Supervisory	52	11.4
Outsider	43	9.4
Total with Data	455	100.0
No Data	58	
Total	513	

Some Typical Fires in Packing Houses.

Smoke House.

S-25339. A fire broke out at 1 A. M. in the smoke house. The night men had just emptied the smoke house and probably the inrush of fresh air when the iron doors were opened supplied the necessary oxygen to allow a smouldering fire to burst into flame. The watchman located the fire but could not find a key to the fire alarm box and wasted some time in hunting for it. He finally telephoned the fire department but in the meantime the fire had passed through the open door of the smoke house into a 2½ story shingle roofed frame building adjoining. The fire badly damaged the second floor and gutted the attic where paper was stored. A burning brand from the roof, carried by a fresh breeze, lodged on the roof of the four-story brick soap factory about eighty feet away, probably in a wooden ventilator. The grease in this building made a dense smoke and as the fire doors were all open the fire spread rapidly through all three sections of the fourth floor and down to the third floor.

Sprinklers were being installed in the plant at the time of the fire and the installation was complete in the frame fertilizer building and the system full of water with a temporary ¾-in. connection for testing the system. This building adjoined the smoke house. One sprinkler opened and kept the fire from entering the building.

The fire was extinguished after several hours of hard work by the fire department. The loss was $240,000.

S-34634. The fire occurred in a small fire-resistive vault used for smoking meats. The vault was charged after working hours, using oak logs and sawdust for smoking. Grease dripping from meats on to the smudge ignited. The fire was confined in the brick vault until the steel doors warped from the intense heat. Two sprinklers outside opened and prevented the fire from spreading outside of the vault. The fire department had to break in two doors and chop through a partition to get at the vault. About 700 pounds of meat was completely destroyed and some of the woodwork was badly damaged.

H-13805. The fire occurred in a smoke house which was located in a space underneath a train shed. There were three smoke houses in brick shafts with reinforced concrete floors. The ceiling was formed by the floor of the train shed.

The fire occurred due to overheating and the subsequent ignition of grease on the walls of one of the smoke houses. The fire was discovered by a watchman who opened the iron doors to the vault. Flames burst out and he apparently became confused and ran off leaving the doors open. The fire soon communicated to the ceiling members and to some wooden frames nearby. About three-quarters of an hour elapsed before the fire department had streams on the blaze as there was delay in sending an alarm. The floor was stocked with hams and sausages on wooden racks and a very hot fire resulted. The asphalt top on the platforms of the train shed melted and ran into the smoke houses accelerating the blaze. The fire was confined to the region of the smoke houses but it was not extinguished until noon of the next day. The loss was large.

Fertilizer Building.

H-27929. The fire occurred in a three-story brick, joisted building used for drying and preparing fertilizer. The first floor was occupied by two rotating dryers, heated by steam coils. The dryers were rotated by a countershaft driven by a direct current motor of about 50 horsepower. An employee arrived at the plant early in the morning and threw in the switch to start the motor. A spark from the switch ignited the dry powdered fertilizer and flames flashed through the room. The employee ran out of the door and gave the alarm. An engine company arrived within five minutes but by that time flames were coming out of the windows on all floors. An open stairway at the center of the room from the first to the second floor allowed the fire to spread rapidly. The firemen could not enter the building but did good work from the outside and extinguished the fire in less than an hour. The loss to the building and contents was large.

Poultry House.

H-15897. One employee was in the building on Sunday afternoon engaged in feeding poultry. He noticed fire in the corner of the building and called the fire department by telephone and then unsuccessfully tried to extinguish the fire with a chemical extinguisher. After the fire department had arrived and had the fire practically under control an explosion took place in some ammonia tanks which were stored in the building. A few minutes later another tank exploded, killing two men and injuring five others. Three buildings were destroyed by the fire and several others were badly damaged.

Sausage Manufacturing Room.

S-31633. The fire took place on the second floor of a three-story brick joisted building. On this floor there was a considerable quantity of cottonseed oil and a wood pile for firing some smoke ovens. The fire apparently started near the smoke ovens possibly due to a spark from the ovens. Near the wood pile and but a few feet from the ovens was a large gas meter with three inch pipe connections. The oil and the wood made a hot blaze and melted the solder on the gas meter, allowing the meter to fall apart. The gas quickly spread the fire throughout the room. Practically all the sprinklers in the room opened at once but they did not check the fire. The fire department arrived promptly and put out the fire after about three hours. During the course of the fire the third floor gave way and broke off a 3 inch sprinkler pipe, thus crippling the sprinkler system. The sprinkler pipe from a dry valve in the basement passed through a cold room and ran close to a bank of refrigerating pipes and then turned up into the warm room above. It is probable that moisture in the pipe condensed and formed an accumulation of ice inside the pipe at the base of the riser just below the first floor. The unsatisfactory operation of the sprinklers may have been due to this obstruction.

Slaughter House.

S-24628. The fire occurred in the second story of the slaughter house used as a killing floor. The main ceiling of this room was over

nineteen feet above the floor but about seven feet below this ceiling were timbers for supporting the machinery hoists, etc. Portions of the space where the timbers were located were floored over and on one of these platforms was a closed steel tank of 24 gallons capacity. This tank contained kerosene at a pressure of from 40 to 80 pounds for use in a torch for singeing hogs. A line of half inch pipe led from the bottom of the tank and was connected to the torch by a hose. A pet cock on the burner used to shut off the oil supply leaked and while employees were endeavoring to make this tight the plug blew out. Burning oil was sprayed around the room and 87 sprinkler heads opened. The fire burned fiercely for a short time but was completely extinguished by the sprinklers. A fire alarm was turned in but the fire was out before the department arrived.

Stock Yards.

H-10630. The fire started in an open stock pen in some loose hay, undoubtedly from a carelessly discarded match or cigarette butt. It was discovered by a watchman at 9:28 P. M. and an alarm was turned in. The fire spread rapidly and a strong wind caused it to jump from pen to pen, feeding on the straw bedding, hay, and wooden structures. When the firemen arrived it had covered a large area and was beyond control. It continued to spread until about sixteen acres were burned. The flames were not under control until 3:30 A. M. Over 4,000 head of cattle were removed from the pens. Six head of cattle were burned to death. The property loss was approximately $150,000.

Lard Refinery.

H-6656. The fire occurred on the morning of a holiday on the second floor of a five-story brick joisted building. It was caused by spontaneous ignition of greasy rags left in the building the day previous. The building was occupied on the first and second floors for the storage of wooden containers; on the third as a cooling room for grease; on the fourth for vats, tanks, and containers; and on the fifth for lard rendering. The combustible nature of the contents and the fact that there were openings in the third floor around the grease vats, greatly aided the fire in gaining headway. The fact that the laundry for press cloths was on the top floor of this building probably did not have anything to do with the fire, but it is of interest to note that greasy cloths washed with caustic soda and not perfectly cleaned are more liable to spontaneous ignition than before the washing. The cause for this is probably due to fibres of the cloth being impregnated with grease in the cleansing process, the grease thus becoming more finely divided, and the heating being accelerated by the caustic soda.

The alarm was turned in by an employee and the private fire brigade tried to hold the flames in check until the city department arrived. Three men were running a hose in from a covered passageway when an explosion occurred, probably caused by the fiercely burning grease, and filled the floor with a dense black smoke. Two of the men were able to reach the outside but the third was suffocated. The fire spread to an adjoining five-story building through openings made in the wall by the heavy girders supporting the grease tanks which pried open and weakened the

wall when the tanks fell. The fire also spread to a frame grease storage building through the iron doors left open by the fire brigade when escaping from the building. The loss on the three buildings was total.

Hog Cooler.

H-3255. The fire started from a defective starting rheostat of an electric motor on the first floor of a seven-story mill construction building. The fire spread rapidly and the firemen were unable to enter the building owing to fumes from the pickling vats and the burning of the asphalt covered floors. Twenty hose streams were poured into the building from 7 P. M. until 11 A. M. Fifty-seven firemen were overcome by smoke and gas. The fire was confined to the first and second floors. The loss was approximately $18,000.

Engine Room.

H-16661. Two mechanics were working with a lighted blow torch in a room adjoining the engine room, the door between the rooms being open. There were two ammonia compressors in the engine room and the end of one of these blew out. The escaping gas was ignited by the flame of the blow torch and an explosion occurred. The resulting fire destroyed a section of the plant. The loss was $7,000.

Bone Room.

S-30583. The fire started in a wooden crate containing wooden skewers. The fire was apparently caused by spontaneous ignition of greasy material brought to the crate by rats. Rats were very numerous around the plant and examination of the contents of the crate after the fire disclosed fragments of cloth, paper, bones, etc., evidently brought by the rats. One sprinkler opened and held the fire in check. An employee with one hose line extinguished the fire with small loss.

The West St. Warehouse Fire, New York.

Report by New York Board of Fire Underwriters.
(Member N. F. P. A.)

A fire which broke out at 5:34 A. M. on August 26, 1923, caused large property damage to a warehouse at 284 West Street, New York. This fire is one of a number of serious warehouse fires that have occurred in New York City during the past year and it calls attention to many of the difficulties that may be encountered in combating warehouse fires.

Construction.

The building was a five-story and basement ordinary brick L shaped building in good repair. The roof was of joisted construction with composition and tin covering. The floors were one inch planks supported on wooden joists and posts. The stairway and hatchway were open with non-automatic wooden traps. There were no fire divisions. There were two interior walls with large unprotected openings on all stories. Three sides of the building were blank walls. On the side facing the street there were windows with flat framed iron shutters and similar openings on the L in the third, fourth and fifth stories only.

Occupancy.

Basement—Hatter's fur and olive oil in cases, dyestuff and olives in barrels, cotton yarn in bales (skidded).

First floor—Dried cherries, cheese, canned goods, figs, machinery and olive oil in cases, nuts and beans in bags, straw braid in bales, tartaric acid in barrels and kegs.

Second floor—Cheese, crockery, hatter's fur, straw braid, paper, musical instruments and artificial flowers in cases, nuts and beans in bags.

Third and fourth floors—Artificial flowers, crockery and straw braid in cases.

Fifth floor—Artificial flowers, crockery, straw braid and straw hats in cases.

Protection.

There were five fire pails on each floor. The building was also equipped with an approved automatic fire alarm. Public protection was normal, but the building was inaccessible because of the unpierced brick walls on all sides except the side facing the street. The building is located in a separate fire main district and a fire boat is available.

Story of the Fire.

The fire originated from unknown cause on the third floor of the rear or L and spread through the entire building, but did not enter other buildings. Spontaneous combustion and thieves have been mentioned as possible causes of the fire, which is mysterious, having started as it did at 5:30 A. M. on a Sunday morning.

The automatic fire alarm in the building turned in the first alarm at 5:30 A. M.; a street box was pulled at 5:32. Upon arrival of the fire department, second and third alarms were turned in at 5:45 and 6:05 respectively. A total of twelve engine, four truck, one rescue and one searchlight companies reported at the fire.

Owing to the narrow frontage of the West Street portion of the building, the inaccessible location of the rear portion, crowded stock and dense suffocating smoke caused by the fire, considerable difficulty was experienced by the fire department. It was necessary to make large breaches in the fire wall separating this and the adjoining warehouse on the south. Three large openings were broken through this wall on the fifth floor and two on each of the other floors above the basement, except only one on the first. Large portions of the roof of the adjoining building were torn off to permit ventilation and to determine whether the fire had spread into this building. Five openings were also cut through the walls of the burning building directly over the roofs of other lower adjoining buildings. The burning building contained large quantities of merchandise which prevented the hose streams on West Street from penetrating any distance. Heavy smoke and barred iron shutters delayed the fire department in fighting the fire through the windows on the L. These windows faced on an interior court which was filled with heavy suffocating smoke.

Credit is due the fire department for controlling the fire through various breaches in the fire wall without allowing any fire to get into the building adjoining on the south. Numerous firemen were overcome by smoke but were able to return to duty. The smoke which affected them is described as being very heavy and suffocating and therefore hampered the fire department greatly.

Loss.

The building in which the fire originated was gutted and the damage to both building and contents was heavy. The roof and part of the floors fell in.

In the adjoining warehouse there was considerable damage to contents due to smoke and water which entered through breaches made in the fire wall separating this building from the one in which the fire oc-

curred. Smoke is also said to have gotten into the building at some places where the floor beams enter the wall. As far as can be seen, however, the brickwork appears to be well fitted around beams. Considerable water seaped through this wall. The loss by water was substantially increased in this building owing to the fact that the merchandise was piled close to the ceiling in many places and aisles were obstructed by packages stored therein, making it impossible for the patrol to adequately protect the goods by covers.

Conclusions.

The outstanding features of this fire are overcrowding of stock and the large damage in the adjoining warehouse which was separated by a good blank fire wall from the building in which the fire originated and to which it was confined. This heavy loss in the first named building was chiefly on the contents and resulted from smoke and water which penetrated the building, due in large part to the numerous breaches made in the fire wall to afford access to the fire for hose streams, the lines for which were brought up through this building.

Accessibility of warehouses to public fire protection is an important feature to be taken into consideration. Similar lack of access has been the cause of heavy losses in connection with other fires in warehouses. The advantages of isolating unsprinklered public warehouses from fire in exposing buildings must be balanced against the danger of thereby rendering a warehouse inaccessible for fighting fire in the building itself.

Office Buildings — Fire Record.

That the average "fireproof" office building is not safe from fire is the conclusion drawn from a study of office building fire reports in the files of the National Fire Protection Association. While the 119 fire reports included in this record represent only a small proportion of the total number of office building fires occurring, they afford interesting data on this class of building, and enable drawing general conclusions as to the predominant hazards of this occupancy.

Forty-six of these fires caused losses of more than $5,000. It is interesting to note that thirteen of the fires were in fire-resistive buildings. The more important of these are described later in this record or have been previously reported in issues of the QUARTERLY. Of the remaining thirty-three buildings in which large damage occurred, twenty-nine were of brick, joisted construction, and four were of ordinary frame construction. The value of automatic sprinkler protection for office buildings is demonstrated by the fact that none of these large loss fires occurred in buildings having automatic sprinkler protection, while in unsprinklered buildings 57.5 per cent of all fires caused losses of over $5,000.

The spread of the fire through unprotected vertical openings was definitely responsible for the large loss in sixteen of these fires. Four of the thirteen fires in fire-resistive office buildings were spread through unprotected vertical openings.

There are obviously no causes of fire in this class that can be considered as special hazard causes. "Matches—Smoking" is responsible for nearly fifty per cent of the known causes of fire. While only ten of the fires reported were awning fires, there is little doubt that the awning fire is the most frequent type of fire that is encountered in office buildings. These are usually of comparatively small loss and are not reported. The aggregate yearly loss from awning fires has never been ascertained but it would undoubtedly be a surprisingly large figure.

As previously indicated the sprinkler record for the class shows 100 per cent efficiency. The 39 fires in which sprinklers operated were all extinguished or held in check by the sprinklers with small loss.

Over sixty per cent of the office building fires occurred at night; it is to be expected that fires would gain more headway at night than

during the business hours of the day when there is constant movement of people in and around the building.

It is interesting to note that less than half of the fires originated in office rooms. The basement areas of the building offer the best opportunity for fire to start and to spread.

The Building Owners Association Fire Record.

A fire record compiled by the National Association of Building Owners and Managers (member N. F. P. A.) from reports of their members furnishes interesting corroboration of the conclusions drawn from the N. F. P. A. record, although a few points of divergence may be noted. While there is probably some duplication in the fires included in the two compilations, for the most part they cover different fields. The Building Owners and Managers record is not yet complete, but will be continued as one phase of the fire prevention activities of the Association. This record is summarized as follows:—

"From the tabulations made to date, the largest fire loss was due to spontaneous combustion in oily rags. Some twenty-two different causes of fire are reported to date, with cigarette stub fires leading as being responsible for twenty-five awning fires, five other fires and one vault fire; a total of 31. Seventeen fires are listed under 'cause unknown,' and among the various other reasons—electric fans, flashlight, excelsior, electric heater and gasoline are charged as responsible for one fire each. Of the figures given classifying fires by location (aside from awnings) basement fires lead with first floor fires close behind."

Office Buildings.

Total Number of Fires Reported, 119.

Causes of Fires.

	No. of Fires	Per Cent
Matches—Smoking	38	46.9
Spontaneous Ignition of Oily Rags	11	13.6
Heating	8	9.9
Defective Electric Wiring	6	7.4
Power	4	4.9
Rubbish	3	3.7
Gas Explosion	2	2.5
Miscellaneous	9	11.1
Total	81	100.0
Unknown Cause	38	
Total	119	

Effect of Sprinklers.

	No. of Fires	Per Cent
Extinguished Fire	24	82.7
Held Fire in Check	5	17.3
Total	29	100.0

All these sprinklers were on the wet system.
There were 10 fires in which no sprinklers operated.

NUMBER OF HEADS OPENED.
(Average 2)

No. of Heads Opened	No. of Fires	Per Cent
1	19	65.5
2	4	13.8
3	2	6.9
4-10	3	10.4
15	1	3.4
Total	29	100.0

Analysis of Loss.

	Sprinklered Fires	Per Cent	Unsprinkleed Fires	Per Cent	Total	Per Cent
Small Loss	39	100.0	31	38.8	70	58.8
Large Loss	..	..	46	57.5	46	38.6
No Data	..	..	3	3.7	3	2.6
Total	39	100.0	80	100.0	119	100.0

Room in Which Fire Occurred.

	No. of Fires	Per Cent
Office Room	49	41.2
Basement	14	11.8
Awning	10	8.4
Storage	9	7.6
Boiler	6	5.0
Waste Paper Vault	5	4.2
Service Area	9	7.6
Miscellaneous	17	14.2
Total	119	100.0

How Discovered.

	No. of Fires	Per Cent
Employee or Tenant	41	34.5
Outsider	38	31.9
Watchman	17	14.3
Sprinkler Alarm	12	10.1
Supervisory	3	2.5
Thermostat	1	.8
No Data	7	5.9
Total	119	100.0

Time of Day.

	No. of Fires	Per Cent
6 A. M. to 6 P. M.	39	32.8
6 P. M. to 6 A. M.	73	61.3
No Data	7	5.9
Total	119	100.0

Some Interesting Fires in Office Buildings.

H-10169. SEPT. 29, 1914. NEW YORK. This fire clearly shows that a fire-resistive office building may contain enough combustible material to make a fire of considerable severity. The building was an eleven-story structure. The floor arches were of tile on steel beams and girders on brick bearing walls and steel columns. The columns were fireproofed with 2 inch hollow tile. The fire, probably due to careless smoking, was discovered by a watchman at 3 A. M. The fire started in an office on the eighth floor and spread through the thin glass and wood sash doors to five other offices.

The fire department fought the fire with hose streams from the standpipe, connections being made from high pressure hydrants to the steamer connections. The fire was extinguished in about an hour.

In the room where the fire started, the furniture, wood doors, sidelights, window frames, and plaster finish were destroyed. The trim and contents of the other five rooms were also badly damaged.

H-10467. OCT. 16, 1914. WORCESTER. The fire occurred in the fourth and fifth stories of two adjoining buildings of brick joisted construction. The cause of the fire is unknown, but was probably due to careless smokers in a small room used in connection with a lodge room on the fourth floor of the adjoining building near an open stairway. Outsiders gave the alarm at 9 P. M. When the fire department arrived the fire had spread through the two upper floors of both buildings. The hollow wall construction, open halls and stairways, open elevator and air shafts, and blind attics, greatly aided in the rapid spread of fire once it had burned through the partitions. The division wall between the two buildings was defective and fire doors were not closed. The two upper floors were gutted. The loss was approximately $25,000.

H-15604. JUNE 22, 1919. NEW YORK. The building was a 20-story fire-resistive structure. There was a large attic space over the top floor used for storage of old partitions, furniture, and records. The fire originated in a space in this attic used for the storage of plans and records and enclosed in wood partitions.

The watchman visited the attic space at 11:45 P. M. At 3 A. M. the night engineer went to the attic space and found one end in flames. He went to the street floor and called to the watchman to turn in an alarm, before going to the engine room to start the fire pumps. The fire department connected the high pressure system to the standpipe. The water pressure was increased to 125 pounds, as is the custom on the

receipt of all first alarms, and this pressure was ordered to be increased thirteen minutes later to 150 pounds. The pressure at the nozzle in the attic was not sufficient and pressure was increased to 175 pounds. Three 2½-in. lines were used, connections being made at standpipe outlets in the attic and on the twentieth and nineteenth floors. The fire was controlled in about twenty minutes.

The contents at one end of the attic space were destroyed. The heat softened six unprotected steel columns placed under beams for additional support of the roof structure.

The extensive storage of highly combustible materials on the upper floors of a tall office building is dangerous practice, especially without automatic sprinkler protection.

H-16933. DEC. 28, 1920. LANSING. The building was a six-story office building of ordinary brick joisted construction. The fire started in the basement from spontaneous ignition in rubbish in a restaurant at 4 A. M. There was an open elevator shaft located in the center of the building and by the time the fire department arrived the fire had spread up through the wooden joist channels to the second floor and along to the elevator shaft and from there throughout the building. The building was a roaring furnace and the firemen devoted their attention to saving adjoining property. The building was a total loss, estimated at approximately $300,000.

H-18136. DEC. 24, 1921. DES MOINES. The building was five stories with brick walls. The first floor was reinforced concrete, other floors being of wood. The fire started in the rear of the second floor, probably from defective electric wiring. The watchman discovered the fire at 5:20 P. M., shortly after coming on duty. He attempted to send in the alarm by telephone but the circuit had evidently been broken. He had to go out and send the alarm from a nearby store. Much valuable time was lost by this delay. When the fire department arrived the fire had spread to the upper floors through the open elevator shaft. A second alarm was sent in at once. The fire rapidly travelled upward and involved all floors. The roof collapsed and carried down with it all the floors below.

Nineteen hose lines were used for about three hours before the fire was under control. The building was entirely gutted, the loss being $600,000. This fire again emphasizes the importance of enclosing elevator shafts with incombustible material.

H-18900. AUG. 29, 1922. TULSA. The building was fourteen stories high with an occupied roof space above. It was of reinforced concrete column, beam and slab construction throughout. The building was occupied for offices on all fourteen floors. The roof space was used for storage of janitor's supplies, old files and other miscellaneous material. There was a private apartment in the roof house, unoccupied at the time, but expensively furnished. An L shaped opening had been cut through the reinforced concrete slab between the roof space and the apartment above for installation of a pipe organ. This opening facilitated the spread of fire to the apartment.

The fire originated in the roof space near where a quantity of inflammable materials were stored. The cause was probably spontaneous ignition of oily cleaning rags carelessly left about. The first companies to arrive went by elevator to the fourteenth floor with hand extinguishers, but could advance only a few feet into the roof space because of the heat and smoke. Streams from standpipe connections on the thirteenth and fourteenth floors were then used. These streams could not reach the base of the blaze but materially assisted in preventing spread of the fire.

The 75 foot water tower was used without effect owing to elevation and the windows in the roof space being only 18 in. square and set in behind apertures in the cornice.

A deluge set supplied by pumpers through a six inch standpipe on the 10-story building across the street placed some water in the roof space, although the distance and height were too great for an effective stream.

There were no skylights or vents in the main roof slab and it was impossible to vent the roof. It was necessary to scale the roof of the fifteenth floor by means of the fire escape and drop one story to the main roof in order to open doors and windows on the north and west sides of the apartment. The fire was then quickly extinguished in the apartment by a hose stream attached to an outside standpipe on the roof of the fourteenth floor and supplied by a pumper. The loss to building and contents was $210,000.

H-19725. JULY 12, 1923. CHATTANOOGA. A new fire-resistive office building was under construction. In course of construction it became necessary for the electrician to cut a conduit pipe in the ceiling of the first floor, by the use of an acetylene torch. A fresh layer of "Mastic Flooring" had just been applied on the second floor, and in cutting the pipe a spark from the torch ignited this material. "Mastic Flooring" is a composition of asbestos and eleolite mixed with gasoline to cut the body and soften it while applying. The gasoline is absorbed or evaporates in the air leaving a pulpy floor similar in effect to linoleum. Eleolite is a by-product of peat which is imported from France. The flooring is not inflammable to any extent except before the gasoline has evaporated.

The fire flashed over three rooms of the second floor almost instantly, destroying the flooring, burning out several window and door frames, and breaking the windows in all the rooms. No one was working in these rooms at the time and no fatalities occurred. The loss was estimated at $2,500.

NOTE: Other interesting reports on office building fires have appeared in the QUARTERLY as follows:

The Equitable Building, New York, January 9, 1912. Vol. 5, No. 4, page 408.

Emerson-Brantingham Co., Rockford, Ill., February 28, 1912. Vol. 6, No. 1, page 108.

Chamber of Commerce Building, Rochester, N. Y., May 24, 1918. Vol. 12, No. 2, page 199.

Chamber of Commerce Building, New Haven, January 15, 1920. Vol. 13, No. 3, page 231.

Fire Report H-18773. Vol. 16, No. 2, page 212.

Fires in Which There Was Loss of Life.

These notes are intended to point out typical conditions under which loss of life has occurred, that they may be known and guarded against.

Smoking.

H-19819. MEMPHIS, TENN., JULY 31, 1923. A match thrown aside by a pedestrian who was lighting a cigarette caused an explosion of gasoline and a fire which resulted in the death of a young woman and the injury of three firemen. A tank wagon was filling an underground tank at a garage when the man passing by started to light a cigarette. Disregarding the warning of a bystander, the smoker threw the match near the tank opening. The explosion followed, and flames flashed up to a second story window, igniting the dress of the young woman. She was dead when aid reached her. The smoker escaped in the confusion.

Kerosene.

H-19728. HAGERSTOWN, MD., AUG. 1, 1923. Fire occurred in a brick tenement house when a girl attempted to start a fire in the stove with kerosene. The can exploded instantly killing the girl. There was only one stairway in the house and this led up from the kitchen. The father tried to save his wife, a paralytic, by dragging her to the head of the stairs, but he was compelled to abandon her and jumped through a window after being badly burned. Another daughter escaped with a broken leg by jumping from a window.

Gasoline and Naphtha.

H-19847. WARREN, PA., MARCH 23, 1923. Two employees at a machine shop were trying to open the outlet of a drum of gasoline when an explosion occurred that killed both men and scattered blazing gasoline in all directions. The explosion was undoubtedly caused by a spark struck from a chisel that one of the men was using in trying to open the drum. The adjacent buildings were of light frame construction and two of these were totally destroyed. The property loss was $75,000.

S-35352. READING, PA., JUNE 18, 1923. The plant where the fire occurred was a paint and varnish works. A kettle of hot varnish was being thinned by adding naphtha. The varnish is boiled in a large kettle mounted on wheels and is then drawn by hand to the thinning building where naphtha flows by gravity from an elevated tank into the varnish

kettle. As the naphtha is added to the hot varnish a vapor forms under the naphtha on the surface of the varnish and it is necessary to let this vapor escape very slowly by punching the mixture carefully with a stick. A young man, recently employed by the company, was alone in the thinning house working with a kettle of hot varnish. He had been cautioned by the foreman of the danger involved but evidently he was careless and allowed the vapor to escape too fast. The contents of the kettle boiled over and ignited, burning him severely. He rushed out of the room and other workmen extinguished the flames on his clothing. His burns were so serious, however, that he died three days later. The fire department responded and used some chemical streams but with practically no effect. The fire was finally extinguished by employees bringing earth in buckets and throwing the earth into the room. The property damage was small.

H-19449. NEW BEDFORD, MASS., JUNE 22, 1923. A very serious fire occurred at the city garbage reclaiming plant causing the death of two employees and the complete destruction of the building. The processes of this plant were as follows: The garbage was first subjected to direct fire heat in a large rotary oil-fired burner. It was then placed in large closed kettles and cooked under steam heat with 400 gallons of naphtha having a flash point of about 165° F. After this preliminary cooking, the solvent was drawn off and the kettles refilled with fresh solvent and washings repeated until all grease was removed from the garbage. Then live steam was turned into the kettles until all traces of naphtha had disappeared. The vapors were carried off to condensers and the solvent was distilled off. As can be seen the process was a very hazardous one. The fire occurred as a result of the overheating of the inflammable solvent or possibly was caused by sparks from electric wiring. The spread of fire was extremely rapid and the building was totally destroyed in a short time. The two employees on hand were so severely injured that they could not tell the cause of the fire before they died.

H-19773. KELSO, WASH., JUNE 24, 1923. Fire spread rapidly in a frame pool room building when a gasoline cigar lighter exploded. A man was asleep in an upstairs room and the fire gained so much headway that he was overcome by smoke and unable to reach the only stairway. The fire destroyed the building and damaged adjoining buildings. The loss was $12,000.